

LONG-TERM DYNAMICS OF MOBILITY

– Introduction to the Theme of the Special Issue –

Jean-Loup MADRE

*Director, Department of Transport Economics and Sociology (DEST)
French National Institute for Transport and Safety Research (INRETS)
Noisy-le-Grand, France*

Toshiyuki YAMAMOTO

*Associate Professor, Department of Civil Engineering
Nagoya University
Aichi, Japan*

1. INTRODUCTION

Better understanding and forecasting of household vehicle ownership and use have been an important research topic for road network planning and urban planning to seek appropriate modal share between car and public transit. Moreover, the transport sector accounts for a significant portion of total CO₂ emissions resulting in global warming, thus the decrease of CO₂ emissions from household vehicle use is strongly required these days. A reduction in CO₂ emission can be obtained by both using more fuel efficient vehicles and driving less kilometres, as well as having more passengers per vehicle. In both cases, the understanding of household vehicle ownership and use is the key to develop effective policies to make these changes possible. Moreover, the automotive industry is particularly affected by the down-turn of the economy.

Vehicle ownership is a fundamental factor to shape people's mobility, but the adjustment of the ownership to the environmental change does not occur spontaneously. Rather, the change in vehicle ownership may involve time lags and state dependency at the individual household level. In order to understand the behaviour over time, it has been recognized that a panel survey is more effective than a cross-sectional survey; the former observes the change in the behaviour directly by looking at the same respondents at different time periods while the latter only observes respondents once, therefore being unable to observe change^{1,2}. In the context of household vehicle ownership and use, a panel survey allows us to directly observe how people change their behaviour, for example, when fuel prices rise or decrease. Some may reduce the number of kilometres travelled, while others may change for a more fuel efficient car (e.g., diesel in Europe). However, the panel survey also has several disadvantages including panel fatigue, panel conditioning,

etc. Panel fatigue represents the case where respondents get tired of answering questionnaires at later times of the survey, and panel conditioning represents the case where the questionnaire at former times of the survey affects the behaviour of the respondents at a later time of the survey. We have to find efficient survey timings and structure for observing household vehicle ownership and use while minimizing the problems related to the panel survey.

Although the panel survey is effective, we cannot observe past behaviours by starting the panel survey from now. One of the alternatives is a retrospective survey, where past behaviours are retrieved from the respondents by asking the timing and types of specific behaviours and life-course events in a retrospective manner. Fortunately, vehicle ownership such as the timing and the type of vehicles owned in the past is relatively well remembered as well as life-course events such as marriage and residential relocation. However, a retrospective survey relies on the memory of the respondents, and the longer the events occurred in the past, the more difficult to answer correctly in the survey^{3,4}, except for very old people, who remember better ancient than recent events, thus the possible incompleteness of the information obtained by a retrospective survey should be taken into account. Another type of data is repeated cross-sectional data. Though cross-sectional data cannot provide direct observations of a change in behaviour, it is readily available in most cases, and some of the data sets have very long survey periods, which is significantly useful in investigating the long-term dynamics of mobility.

2. CONTENTS OF THE SPECIAL ISSUE

We are grateful to Professor Ryuichi Kitamura, who initiated this special issue after the very successful International Conference on Travel Behaviour Research, which he organised in August 2006 in Kyoto. The session

on Long Term Dynamics at this Conference, chaired by Jean-Loup Madre, provided the first papers for this special issue. This is also the result of a SAKURA collaborative project between Japan and France on Automobile and Multi-modality, which we conducted between 2004 and 2006 in parallel with a working group on the same topic for the European COST Action “Changing Behaviours for a More Sustainable Mobility”. Thus the authors of papers in this special issue are from Japan and France, as well as from Switzerland and the UK.

In this special issue, the papers on the long-term dynamics of mobility, especially vehicle ownership are presented. The first half of the papers were published as Part 1 in Volume 32, No. 2 in 2008, and the latter half are included as Part 2 in this volume. Four papers were included in Part 1. *Papon and Hivert* investigated renting a car and sharing a car within household. These car usage patterns are one of the alternatives to drive their own cars, and regarded as reducing car dependency. They used the French automobile panel survey called Parc-Auto, and examined the characteristics of those who rent a car and share a car within households from 1994 and 2001. On the other hand, by using retrospective survey data covering the 20-year period from 1985 to 2004 in Switzerland, *Beige and Axhausen* investigated the ownership of mobility tools including car ownership and public transit season tickets. They examined residential and occupational location choice as well as mobility tool ownership and the mode of commuting as long-term and mid-term decisions. They applied age-cohort analysis on car ownership and public transport season ticket ownership to examine the effects of cohort and life-course. They also applied logit models for mobility tools ownership and hazard-based duration models for residential, education, employment, car availability and season ticket ownership duration. *Yamamoto* also examined the effects of life-course events such as child birth and residential relocation on the vehicle ownership dynamics. He used the French panel survey data used in *Papon and Hivert* and also Japanese retrospective survey data, and applied hazard-based duration models for vehicle transactions and a logit model for a change in the number of vehicles owned by households. *Dargay et al.* investigated car availability including privately owned and company owned at more than ten of European Union member states. They used the European Community household Panel (ECHP) from 1994 to 2001, which is not primarily a transport survey, but a few questions are asked relating to car ownership. They developed dynamic binary probit models incorporating state dependence, unobserved heterogeneity and serial correlation,

and examined the dynamics of car availability as a function of income and socio-demographic characteristics.

Another four papers are included in Part 2. *Armoogum et al.* investigated the uncertainty of the forecast of the age-cohort model. The frequency of trips and travel distance rather than vehicle ownership are the dependent variables of the study, but the objective of the study was to quantify the three main sources of errors in long-term forecasting. The errors in the calibration of the model, the behaviour of future cohorts, and the population forecasts are examined. They developed an age-cohort model by using repeated cross-sectional data from 1976-1998 for Paris and 1974 to 1998 for Montreal, and estimated confidence intervals of each error by the jackknife technique. *Berri* also developed age-cohort models, and examined the accuracy of the forecasts. He used repeated cross-sectional data on car ownership in seven countries including France, Italy, Japan, the Netherlands, Poland, UK and USA from 1977 to 1997 with varying time periods among countries, and compared the projected car fleet by the model with the recently observed values at 2000 and 2005. The difference in the history of car ownership development, the level of economic development, and population density among countries used in the analysis was also investigated. *Sanko et al.*, on the other hand, investigated inter-temporal change and stability of car and motorcycle ownership behaviour of a particular area. They used repeated cross-sectional data from 1981 to 2001 in Japan, and estimated bivariate ordered probit models of car and motorcycle ownership levels for each time period to compare the estimates. Lastly, *Senbil and Kitamura* investigated the optimum survey duration of travel behaviour in general by using a six-week travel diary survey called Mobidrive in Germany. The topic of the study was not specific to vehicle ownership and use, but the search for the optimum duration of the survey is one of the fundamental issues in panel survey design. They examined the number of person trips per day, vehicle kilometres travelled, number of home based trip chains and total travel time by a person. Hazard rate and survival rate are also calculated for the elapsed time between two consecutive participations of an activity. Random effect linear regression models are estimated to examine the ratio of intra-personal variability to that of inter-personal variability, from which the optimum survey duration was inferred.

Finally, we express our sincere condolence that Prof. Ryuichi Kitamura, who initiated this special issue, passed away on Feb. 19, 2009 after a brave struggle with cancer for more than 6 years. We lost a wonderful leader, but his legacy will live on in the hearts of us.

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