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Papu Carrone, Andrea Vanesa; Rich, Jeppe

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Are car ownership preferences changing? An age cohort analysis

Andrea Papu Carrone and Jeppe Rich

Transport Modelling Division, Department of Management Engineering, Technical University of Denmark

Bygningstorvet 116B, 2800 Kgs. Lyngby, Denmark

avpa@dtu.dk

Introduction

Conventionally transport demand models have been developed under the assumption of “static preferences”. However, it is possible that preferences evolve over time and not accounting for such changes may lead to biased forecasts. In this paper we address the question of stable preferences with respect to car ownership and consider if preferences differ across different generations. We use multiple cross-sectional data collected by the Danish Transport Survey over a period of 40 years.

The repeated cross-sectional data provides the opportunity to analyse the evolution of car ownership preferences, as well as to evaluate the effect of age cohorts over time. Methodologically we apply a pooled cross-sectional approach and estimate a generic discrete choice model in which we control for a range of time dependent input variables. These variables include socioeconomic variables measured at the individual level, cost variable for the cost of driving and price index corrections for the price of owning cars.

The hypothesis put forward in the paper is that propensity to car ownership for younger generations is decreasing over time. This hypothesis is confirmed and suggests that car ownership predictions may be affected by upcoming generations’ preferences.

Background

Cohort analysis is typically used to identify the unique effect of a group of individuals that share common characteristics within a defined time-span. By examining cohorts through repeated cross-sectional surveys it is possible to identify a period effect, an age effect and a cohort effect of being born at a specific time in history (Hjorthol et al., 2010).

However, there is not a unique approach to the application of cohort analysis in transport literature. Extensive research recognises the cohort effects merely in terms of age-specific differences in means or frequencies between survey years (Hjorthol et al., 2010; Newbold et al., 2005) . Another stream of the literature relies on “pseudo-panel” approaches which implies grouping individuals or households into cohorts and tracking the cohorts over time (Dargay & Vythoukas, 1999; Huang, 2007; Iacono & Levinson, 2015). The panel setup is generated by treating the averages for the cohorts as unique observations. Since the individuals within each cohort have similar characteristics, the cohorts can be treated as if they were observations of the same individuals over time.

A few others have attempted to include longitudinal cohort effects on car ownership (Jansson, 1991) and mode choice models (Habib et al., 2014) in order to capture aspects such as

preferences evolution over time. The approach presented in the following sections relates to the latter in that we use multiple independent cross-sectional datasets collected by the Danish Transport Survey, which are pooled over time.

Data and empirical approach

An exploratory analysis of the period effect, age effect and effect of being born at a specific time in history is carried out based on the data available in the Danish Transport Survey from 2007 to 2016. Figure 1 plots the average number of cars owned by a household for which the head of the household is at a certain age and has been born within a given time window. Car ownership decisions are generally taken at a household level, nevertheless to conduct an age cohort analysis of car ownership a link between household characteristics and age is required. An approach that has been already used in the literature (Dargay & Vythoulkas, 1999; Iacono & Levinson, 2015) is to define the household head as the oldest person in the household owning a driving license.

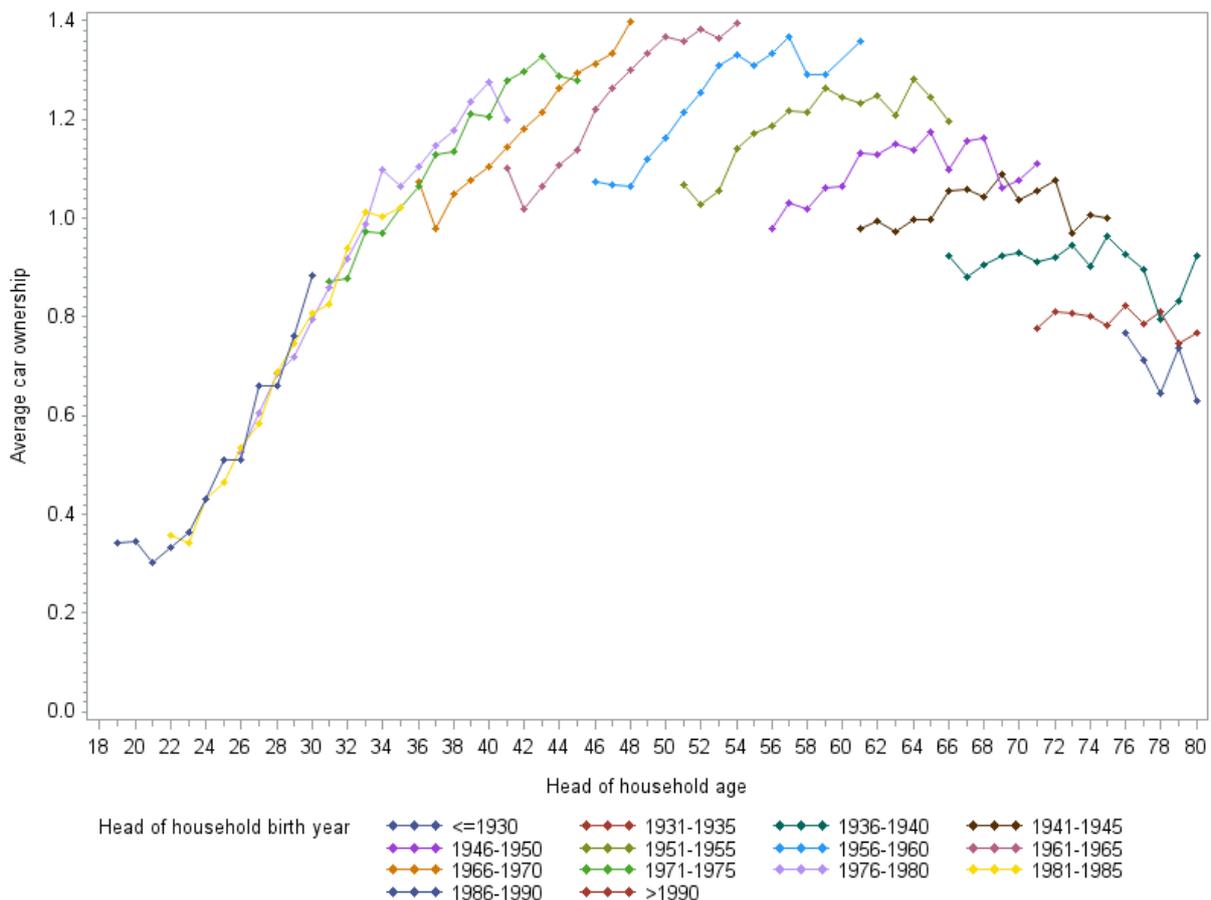


Figure 1: Average household car ownership by birth and age of household head

In accordance with previous studies, in Figure 1 it is possible to identify a life cycle effect and a generation effect on car ownership (Dargay & Vythoulkas, 1999). The life cycle effect corresponds to the increase in the number of cars owned until the age of 55, and thereafter the decrease of ownership. A generation effect can be also observed, at a given age of the household head, car ownership rate is higher for younger generations than for the older ones. This difference among generations appears to decline for those that were born after 1975.

A model capable of accounting for systematic confounding effects and of estimating preference parameters for different generation is implemented. It is defined as a multinomial logit model and is estimated for car ownership using pooled cross-sections. Car ownership is studied in three categories: no car owned by a household, one car owned and two or more cars. The overall goal is to estimate the significance of the interaction of age cohort variables and time variables on the car ownership choice. The model includes additional variables accounting for household characteristics and contextual factors as urban or rural areas, and index corrections for the price of cars and fuel. The Danish Travel Survey does not contain information on prices. Therefore, this data is obtained from the national price indices, which are assumed to be equal for all households. For the analysis, we use cluster of years such that age preferences refers to three consecutive years, say 07-09, 08-10 to 15-17. This smoothens out preferences as it essentially becomes a moving average. In the model we control for the induced panel effect by estimating a robust variance estimator.

Results

The number of drivers, income and number of children in the household are found to have a high positive effect on both alternatives of owning one car and owning two or more. A dummy variable for single households is also incorporated to the model and has a significant and positive effect on the choice for owning one car in the household. A dummy variable for urban areas is included to account for the differences in car ownership preferences between rural and urban areas. As expected, the urban variable shows to have a very significant negative effect on the choice of owning a car. Car and fuel price correction indices have both the expected negative effect on car ownership.

Time dummy variables account for the overall effect on car ownership of a given year with respect to the reference. Thus being years with positive and other with negative effects on car ownership. Age dummy variables reflect the life cycle effect that was previously mentioned.

Moreover, as previously stated the main motivation of this paper is to explore the effect of the interaction of age groups dummies with the time dummies that are included in the model. The estimate can be interpreted as the effect on car ownership choice for those belonging to a given age group at a given point in time. The year 2007 and the age group [48 – 57] are chosen as reference levels. Figure 2 shows the value of the parameter estimate and an * indicating if the parameter is significant at a 5% level, for each age group across the different years.

Figure 2a presents the parameter estimates for the choice of owning one car in the household. In this case, it is observed a negative and significant effect of age groups [18 – 27] and [28-37] with respect to car ownership. While all other groups do not present any significant effects, for both these young age groups the effect also increases with time until year 2013. Overall the effect of young age groups on car ownership is negative compared to the reference year 2007, being this already a good foundation to object “static preferences”. However, special consideration should be placed to the period 2013-2016 where it seems as young age groups negative association towards car ownership has decreased.

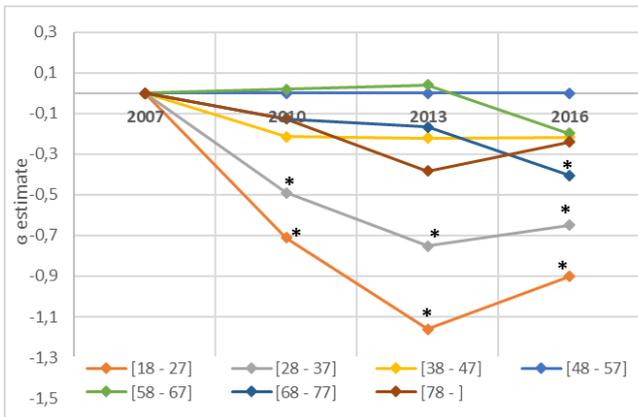


Figure 2a: Effect of the interaction of age groups and time for household which own one car.

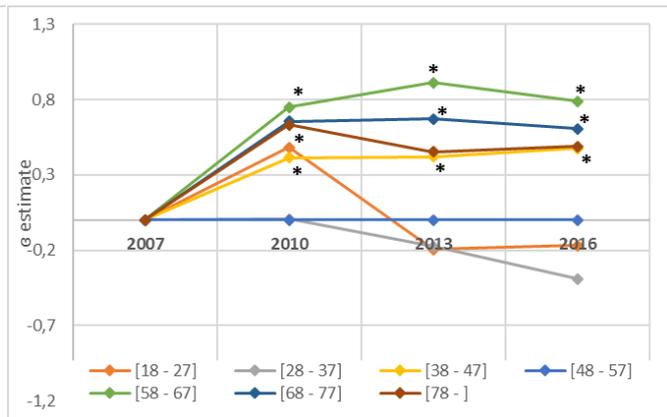


Figure 2b: Effect of the interaction of age groups and time for household which own more than two cars.

Figure 2b pictures the parameter estimates for the choice of owning 2 or more cars in the household. The difficulty to estimate significant parameters for age groups [18 – 27] and [28-37] is most likely related to the few data registers for these classes. Furthermore, it is interesting to observe that all other age groups (individuals over 38 years) are more positively related to owning more than 2 cars in the household in year 2016 than what they were in year 2007.

Results presented in Figure 2a and 2b are included merely as proof of concept. Future efforts will focus in extending the setup in order to benefit of the large and consistent dataset of almost 40 years.

Keywords: car ownership; travel behaviour analysis; cohort effects.

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