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A dynamic analysis of household car ownership

Anne Nolan *

Economic and Social Research Institute, Whitaker Square, Sir John Rogerson's Quay, Dublin 2, Ireland

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ABSTRACT

This paper examines the determinants of household car ownership, using Irish longitudinal data for the period 1995–2001. This was a period of rapid economic and social change in Ireland, with the proportion of households with one or more cars growing from 74.6% to 80.8%. Understanding the determinants of household car ownership, a key determinant of household travel behaviour more generally, is particularly important in the context of current policy developments which seek to encourage more sustainable means of travel. In this paper, we use longitudinal data to estimate dynamic models of household car ownership, controlling for unobserved heterogeneity and state dependence. We find income and previous car ownership to be the strongest determinants of differences in household car ownership, with the effect of permanent income having a stronger and more significant effect on the probability of household car ownership than current income. In addition, income elasticities differ by previous car ownership status, with income elasticities higher for those households with no car in the initial period. Other important influences include household composition (in particular, the presence of young children) and lifecycle effects, which create challenges for policymakers in seeking to change travel behaviour.

1. Introduction

This paper examines the determinants of household car ownership in Ireland, using longitudinal data from the Living in Ireland Survey (LIIS) from 1995 to 2001. This was a period of rapid economic and social change in Ireland, with large increases in employment and average incomes. The number of private car registrations grew by approximately 40%, from 990,000 in 1995 to 1,385,000 in 2001 (Central Statistics Office, 2007), while the number of private cars per household grew from 0.94% in 1996 to 1.12% in 2002 (Central Statistics Office, 2008; Department of the Environment and Local Government, 2003). Despite this rapid growth, in 2004, Ireland had 385 cars per 1000 inhabitants, considerably below the EU15 average of 495 (Eurostat, 2006).

The well-documented shift towards the private car is increasingly regarded as unsustainable on economic, environmental and social grounds. Data for journeys to work, school and college confirm this shift towards the private car; the proportions driving their car to work in Ireland increased from 38.9% in 1996 to 55.1% in 2002, while the proportion of primary school students (aged 5–12 years) travelling as a passenger in a car increased from 35.8% in 1996 to 50.3% in 2002, overtaking the proportions walking (26.0%), which has traditionally been the primary means of transport to school for this age-group (Central Statistics Office, 2008).[1] The resulting levels of congestion impact on all those using the road and public transport network; in the Dublin area for example, average journey speeds in the morning peak for car and bus decreased by 12.4% and 6.2%

* Tel.: +353 1 863 2022; fax: +353 1 863 2100.
E-mail address: anne.nolan@esri.ie

[1] In Great Britain in contrast, the proportion of the population driving to work remained constant at 71% over the period 1998–2002 (Department for Transport, 2009). In Great Britain, the proportion of primary school children walking to school declined from 60% to 51% between 1991 and 1993 and 2002, with a corresponding increase in those being taken by car from 29% to 41% over the same period (Department for Transport, 2004).

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Table 1
Proportion with at least one car by year, and longitudinally.

	No car	One or more cars	>0 and <1
1995	22.4	77.6	
1996	22.6	77.4	
1997	21.7	78.3	
1998	21.0	79.0	
1999	20.7	79.3	
2000	20.5	79.5	
2001	20.5	79.5	
1995–2001	14.2	63.7	22.1

Based on the balanced sample of households.

respectively between 2003 and 2004 (Dublin Transportation Office, 2005).[2] Understanding the determinants of household car ownership, a key determinant of household travel behaviour more generally, is particularly important in the context of current policy developments which seek to encourage more sustainable methods of travel.

In this paper, we use micro-data from a large nationally representative survey of the population over the period 1995–2001 to analyse the determinants of household car ownership in Ireland. Longitudinal data allow us to extend previous cross-sectional analyses of household car ownership behaviour to consider the impact of state dependence and unobserved heterogeneity, as well as the impact of observed household characteristics such as age and gender of the head of household, household income, size and location. Controlling for state dependence means that we can determine the degree of persistence or mobility in car ownership at the household level over time. For example, studies of poverty dynamics often find that poverty is a more common experience when examined using longitudinal rather than cross-sectional data (see Layte and Whelan, 2002). A similar picture emerges when examining the extent of household car ownership using both cross-sectional and longitudinal data; if we treat each of the seven waves of our data as an independent cross-section, approximately 22% of households do not own a car, but when examining the data on a longitudinal basis, just over 14% of households present in all seven waves have no car over the course of the panel while approximately 64% always own a car (see Table 1). This suggests that there is some mobility in household car ownership, with approximately one fifth of all households moving from no car to one or more cars or vice versa over the period. Determining the degree of persistence or mobility in household car ownership decisions is particularly important in this context, with international research highlighting the importance of previous car ownership choices on current levels of ownership (see for example, Hanly and Dargay, 2000; Huang, 2005). This in turn has implications for policy measures designed to encourage more sustainable forms of travel.

However, a large part of persistence or habit in household car ownership may be simply due to unobserved contextual, household or individual characteristics that do not vary over time such as attitudes towards the environment and time preference rates. Longitudinal data afford us the opportunity to control for these unobserved characteristics, and as such overcome the problem of spurious state dependence (i.e., persistence due to permanent, unobserved characteristics). The importance of distinguishing between 'true' and 'spurious' state dependence has been highlighted across a diverse range of studies. See (Arulumpalam et al., 2000; Contoyannis et al., 2004; Gannon, 2005; Denny and Doyle, 2009; Nolan, 2007) for applications examining persistence in unemployment, health status, disability status, voting turnout and health care utilisation respectively. Controlling for state dependence and unobserved heterogeneity necessarily complicates the estimation of the models, and Section 4 deals in detail with the appropriate specification and estimation of the models employed.

The purpose of this paper is therefore to estimate dynamic models of household car ownership, decomposing the observed variation in car ownership into components attributable to observed characteristics, unobserved heterogeneity and state dependence. With cross-section data we are able to identify the influence of observed characteristics only. Section 2 provides an overview of previous research in the area, while Section 3 describes the data set employed in this paper and presents some descriptive statistics on household car ownership from both a cross-sectional and longitudinal perspective. Section 4 presents the specification of the model and the econometric modelling techniques employed. Section 5 discusses the estimation results. Section 6 summarises and concludes and details areas in need of further research.

2. Previous research

In this paper, we use micro-data from a large nationally representative survey of the population over the period 1995–2001 to analyse the determinants of household car ownership in Ireland. This microeconomic approach to car ownership demand modelling has its roots in studies based on aggregated data, which attempt to explain the general relationships between car ownership and variables such as population density and average incomes at regional or country level (see Buxton and Rhys, 1972; Fairhurst, 1975; McCarthy, 1977; Said, 1992; Stanovnik, 1990). However, the nature of the data limits the extent to which the underlying behavioural influences on car ownership can be examined.[3]

[2] Bus speeds on Quality Bus Corridor routes (i.e., routes with dedicated road space for buses) only.

[3] See Storchmann (2005) for a recent review of research in this area, including his own analysis which finds a significant effect for income inequality as well as income levels on cross-country differences in car ownership rates.