



Modelling the relationship between travel behaviours and social disadvantage



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ABSTRACT

The purpose of this paper is to model the travel behaviour of socially disadvantaged population segments in the United Kingdom (UK) using the data from the UK National Travel Survey 2002–2010. This was achieved by introducing additional socioeconomic variables into a standard national-level trip end model (TEM) and using purpose-based analysis of the travel behaviours of certain key socially disadvantaged groups. Specifically the paper aims to explore how far the economic and social disadvantages of these individuals can be used to explain the inequalities in their travel behaviours.

The models demonstrated important differences in travel behaviours according to household income, presence of children in the household, possession of a driver's licence and belonging to a vulnerable population group, such as being disabled, non-white or having single parent household status. In the case of household income, there was a non-linear relationship with trip frequency and a linear one with distance travelled. The recent economic austerity measures that have been introduced in the UK and many other European countries have led to major cutbacks in public subsidies for socially necessary transport services, making results such as these increasingly important for transport policy decision-making. The results indicate that the inclusion of additional socioeconomic variables is useful for identifying significant differences in the trip patterns and distances travelled by low-income.

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1. Introduction

Currently, mathematical models of travel behaviour tend to dominate all levels of transport decision-making. This is due to their ability to offer policy-makers convenient *ex-ante* methods to justify broad-brush policies, detailed planned measures and national and local spending decisions (Van de Voorde and Vanellander, 2010). It is widely acknowledged (even the key advocates of such models) that, despite their increasing complexity, most struggle to capture the intricate nuances of people's everyday experiences of the transport system (Hensher and Greene, 2003). This can be particularly important where it is evident that different sectors of the population exhibit fundamentally different travel behaviours, as is often the case with socially disadvantaged groups (Dargay, 2007).

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The development of innovative methodological approaches is fundamental to an improved understanding of these travel behaviours. However, our aim in this paper is not to build new models of travel behaviour, rather we explore whether the *existing standard* transport models and datasets that are in everyday use by transport policy-makers (e.g., [Ortúzar and Willumsen, 2011](#)) can be readily adapted for this purposes. Our rationale is that the transport policy community may be more prepared to adopt familiar and simple models than they would to entirely new methodologies or more complex modelling approaches. It is particularly important that they do so in the context of rapidly changing patterns of car ownership and mode shares amongst low-income sections of populations in the developed and developing world (e.g., [Crôtte et al., 2011](#)).

Our research, which is based on analysis of the UK National Travel Survey 2002–2010, highlights that car ownership trends and trip-making patterns of low-income households differ from the average population. This is because they have greater suppressed travel demands ([Duvarci and Mizokami, 2009](#)). Yet many national and local transport models do not currently account for these disparities, partly due to their use of aggregated trends in travel behaviour models. As such, inaccurate predictions may result, which can have serious implications for policy decisions and investments in new transport systems ([Goodwin, 2012](#)).

The paper is divided into four main sections. The next section provides a background context and rationale for the study, based upon a review of the empirical literatures in this area. Section 3 describes the dataset for the analysis and the overall approach to model development. It then outlines the methods and results for two extended models that include new variables for household income and descriptors of social disadvantage. The final section of the paper sets out the next steps and future challenges for the research and discusses its implications for policy and practice in the UK and elsewhere.

2. Literature review

A background review of the literatures for this research identifies that academic studies of the transport concerns of economically and socially disadvantaged populations have been prolific over the past ten or more years. There is also an increased policy interest in the contribution of transport to the social disadvantage of low-income population groups in the UK and elsewhere ([Lucas, 2012](#)). These concerns have become particularly acute in light of the recently introduced economic austerity measures, which have led to severe cuts in public subsidies in several advanced economies, such as the UK. Concern about meeting the transport needs of low-income population groups is also prevalent in developing cities where there is increased evidence of unequal mobility and accessibility, despite the development of major new transport services ([Manaugh and El-Geneidy, 2012](#); [Jaramillo et al., 2012](#)). However, few academic studies have *specifically* attempted to quantitatively model the influence of income and indices of social disadvantage on people's travel behaviours.

A review of the recent studies of the travel behaviours of socially disadvantaged population groups suggests that these can largely be classified as either: (a) qualitative (largely focusing on the needs and concerns of these population groups) (see [Lucas, 2012](#) for a comprehensive review of this literature); or (b) based around quantitative comparisons of the accessibility of different population groups (e.g. [Neutens et al., 2012](#); [Currie, 2010](#)) and/or geographical areas (e.g. [Páez et al., 2009](#); [Cebollada, 2009](#)). Predominantly, these studies have required dedicated survey data collection and/or the development of non-standard modelling methods. Such studies are extremely insightful in illustrating the complex interactions between travel behaviour and various aspects of social disadvantage (e.g. low income, disability, single parenthood, etc.). Nevertheless, in practice it is often difficult for policymakers to easily adopt these novel techniques within their everyday decision-making practices, due to both their complexity and the lack of suitable data to operationalize them. As such, policy progress to identify and address transport inequalities has been slow in practice. It is in response to this problem with practical delivery and assessment that we believe our research is most useful, because it offers a relatively straightforward way for transport planners to identify the likely effects of their policy decisions on the travel behaviours of socially disadvantaged population groups.

To date, very few studies have undertaken disaggregated modelled analysis of the travel behaviours of transport-disadvantaged population groups (e.g. older people, women, children, disabled people) and also controlled for income effects ([Currie et al., 2009, 2010](#); [Páez et al., 2009](#)). Conversely, studies that have involved disaggregated income analysis rarely consider the additional influence of other variables of social disadvantage. In fact, although comprehensive studies regarding the elasticity of travel and income have been developed in the past (e.g., [Dargay, 2007](#)), these have not segmented in detail the specific effect of income on vulnerable segments of the population such as elderly, unemployed and disabled people. This is largely because it is generally accepted by policymakers that income is not a useful explanatory variable for predicting travel behavioural outcomes and that car ownership is a sufficiently adequate proxy measure for income effects.

An exception is [Roorda et al. \(2010\)](#), who showed non-linear income effects in their trip generation models, controlling for household structure, mobility tools, occupation, and urban form. Similarly, [Mercado et al. \(2012\)](#) report the difference on transport mode use in Quebec and Montreal for low-income groups, depending on aspects such as gender, educational achievement, household structure, and immigration status, controlling for geographical area. Variables of social disadvantage have been included across several different dimensions of travel behaviour, such as trip generation (e.g. [Huntsinger and Roupali, 2014](#)), destination choice ([Scott and He, 2012](#)), mode choice (e.g. [Mercado et al., 2012](#); [Schmöcker et al., 2008](#)) and distance travelled (e.g. [Morency et al., 2011](#); [Mercado and Páez, 2009](#)).

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