Mobility behaviour in multi-channel retail environments: joint model of shopping channel, destination, and mode choice

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The nature of shopping activity is changing, which in turn has potentially highly significant structural consequences for shopping-related mobility. In recent years there has been a proliferation of new retail channels and store formats (e.g., online, Metro, discounters, click and collect) and consumers are increasingly using a wider mix of different retail channels. Of particular importance is the growth in the use of online channels. The UK has the highest proportion of online spending of any nation with the share of online retailing as a percentage of all sales, reaching 12% in 2013 compared to only 0.3% in 1998 and 2.1% in 2002. Shopping's share of total personal trips fell by 20% between 1997 and 2012, with the average distance travelled for a shopping trip increased by approximately 10%. These structural changes may relate, at least in part, to the impacts of certain types of retail activity shifting away from in-store purchases and towards online transactions. However, we currently lack the evidence on which to base any general conclusions about this phenomenon. This reflects inadequacies in existing models and gaps in relevant data linking retail behaviour (including channel choice) and mobility. The effect of this uncertainty is to limit the ability of policy-makers to respond effectively to the implications of changing shopping behaviour. Here, we specifically focus on grocery shopping behaviour as it is the most common and frequent type of shopping. The travel implications of food shopping are of significant importance since food shopping accounts for almost half of all shopping trips in the UK.

There are several weaknesses in existing modelling methodologies. In the context of mobility research, shopping has principally been addressed as a destination and mode choice problem with an overriding focus on the spatial aspects of choice behaviour and with little attention being paid to the choices associated with what is bought or different channels through which the transaction is fulfilled (e.g., in-store purchase *vs* on-line purchase). This is reinforced by the fact that household travel surveys typically do not collect information on in-home activities such as e-shopping. With the growth in internet use, however, the trade-off between out-of-home activities and in-home activities is becoming increasingly important (e.g. online shopping at home replacing a physical visit to the store). In the marketing literature, work on channel choice has largely focused on modelling the choice between online and in-store/physical alternatives with limited representation of the heterogeneity within these channels and with no attention paid to the implications for mobility. In particular, elemental alternatives (i.e. individual stores) and their attributes within the physical channel and travel dimension of choice has not been incorporated. This paper bridges the gap between these two literatures by developing a discrete choice modelling framework for the joint model of channel choice, shopping destination choice, and mode choice.

There is an empirical challenge in studying mobility implications of multi-channel retailing since most travel surveys do not provide information on how in-store and online shopping behaviour interact with one another. To address this challenge, this paper makes use of an enhanced consumer panel dataset on grocery purchases of households combined with physical store characteristics dataset from two boroughs in London (Enfield and Barnet). In the panel, respondents record all grocery shopping activities over time including choice of channel (online vs. in-store), details of chosen stores (location, chain, format), and shopping basket characteristics (products purchased and basket value). The panel data extends over many shopping episodes and purchase data is available up to two years. However, basic consumer panels do not collect data on travel behaviour associated with shopping. Further, visited store location data was missing for more than half of the observed shopping episodes. Therefore, we augmented the consumer panel via an add-on online survey instrument that collected store location and mode choice information on all visited stores in one week. The physical store characteristics dataset contains store size, chain, and location characteristics, and therefore complements the panel data with detailed information on attributes of alternatives in choice sets.

In this paper, we develop a series of discrete choice models for the joint choices of shopping channel, store destination, and mode. These choices are assumed to be three related stages of the household shopping process that can be modelled jointly using a three-tier nested logit structure. Different nesting structures were tested for representing the underlying behaviour and the hierarchy of choices. Furthermore, we explicitly account for correlations in unobserved utility over repeated choices by each decision maker using a mixed GEV model structure. The paper also provides a discussion on potential applications of the developed model in transport planning, town planning and competition policies (e.g., implication of new retail development on existing town and retail landscape) and business strategies (e.g., assessing expansion strategies for different channels).

Keywords: online shopping, channel choice, shopping destination choice, mode choice, online vs. in-store shopping