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Examining tourists' long-distance transportation mode choices using a Multinomial Logit regression model

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ABSTRACT

Modeling of transportation mode choices has in the past primarily dealt with everyday short-distance travel and long-distance business travel. The present paper adds to this research in examining the long-distance transportation mode choices of tourists. The empirical setting is the domestic tourism market in Norway, and the analyses refer to Norwegians' winter vacation trip. Using survey data tapping actual travel behavior and a Multinomial Logit (MNL) regression model, the study shows how travel distance in kilometers and hours, a number of trip-related characteristics and certain socio-demographic variables all affect transportation mode choices. The results show that travel distance variables and trip-related characteristics are the most vital determinants of the transportation mode choices of Norwegian tourists.

1. Introduction

A number of tourism scholars have noted that the modeling of tourists' transportation mode choices is an area in which little research has been done (e.g. Barros, 2012; Hough & Hassanien, 2010; Middelkoop, Borgers, & Timmermans, 2003). Given that these choices of tourists around the world have profound environmental consequences, particularly in the long-distance travel from residence to destination and back again (Böhler, Grischkat, Haustein, & Hunecke, 2006; Kelly, Haider, & Williams, 2007), this state of affairs is puzzling. Another curious aspect of this predicament is that while transportation researchers in abundance have studied how various determinants affect transportation mode choices in both short and long-distance settings, for some reason they have not generally examined the choices that tourists make in this regard (Barros, 2012). Against this backdrop the general aim of the present study is thus to make a contribution to the tourism transportation choice literature, if not to balance the score.

Why do people choose transportation mode alternative A over B or C? Research questions of this type have a long tradition in economics and the social sciences. Following Lancaster's (1966) at-the-time new consumer theory and Domencich and McFadden's (1975) early empirical travel mode analyses, consumers act rationally and choose the alternative that maximizes their (subjective) utility. This general point of departure has, in turn, sparked a wealth of quantitative travel demand studies aimed at modeling how a preference for A over B (or C) or vice versa is dependent on a set of independent variables or regressors.[1] In short-distance or commuting settings, the main motorized transportation mode choices could be between car, bus and train, whereas the analog choices in long-distance tourism might be car, train and air transportation. As mentioned, however, since tourism scholars have failed to see the importance of such choices within their own field of research there have been very few studies dealing explicitly with the transportation choices of tourists. By contrast, several studies in which a utility framework has been used examine the determinants of other discrete tourism choices, such as travel modes or destination choices (e.g. Baltas, 2006; LaMondia, Snell, & Bhat, 2010; Luzar, Diagne, Gan, & Henning, 1998; Nicolau & Más, 2005; Rugg, 1973).

This study scrutinizes Norwegian tourists' long-distance transportation mode choices. The options are traveling (*a*) by private car, (*b*) by air or (*c*) by other public transportation. Within the traditional discrete choice framework, the study links these transportation mode choices to three sets of determinants using survey data tapping information on actual tourism behavior. The next section briefly introduces these three sets of independent variables. Other than this, the paper is structured as follows. A formal model is outlined and the econometric methodology is discussed in Section 3. Section 4 presents the data, describes the variables and offers some descriptive results. In Section 5 the

[1] A comprehensive survey of this literature is beyond the scope of this paper. Some important works are given by Commins and Nolan (2011). Other studies from the general transportation mode literature are cited in a more eclectic fashion, since it is debatable whether or not the determinants of short-distance and/or everyday travel decisions generally carry across to long-distance and non-ordinary tourism settings (Limtanakool et al., 2006).

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econometric results are presented and explicated, whereas Section 6 summarizes, discusses and concludes.

2. Determinants of transportation mode choices in long-distance tourism settings

Apart from situational factors, a number of more invariant independent variables or regressors may affect tourists' transportation mode choices. In this study, three such types of determinants are considered: (1) travel distance variables, (2) trip-related characteristics and (3) socio-demographic variables. Individual or psychological factors comprise a fourth group, whereas the various attributes of different transportation modes (e.g. price, comfort, time, flexibility, and so on) encompass a fifth. In other words, the determinants to be discussed partly follow from the variables available for analysis and the type of data to be analyzed (i.e. revealed preference data). One caveat at the outset is that strict comparisons between this and previous studies – and more generally between all kinds of transportation choice modeling studies – are problematic for a number of reasons. First, the number and type of transportation modes invariably differ from one study to the next (e.g. three choices, four choices or nested choices). Second, the scope and type of independent variables vary (e.g. case-specific or alternative-specific variables or both) as do the samples used (e.g. representative or on-site samples). Third, while a number of studies use "hypothetical" survey data (i.e. stated preference data) others utilize "ordinary" survey data (i.e. revealed preference data). Fourth, and partly as a result of the above differences, the methodologies vary between studies (e.g. Multinomial Logit/Probit, Conditional Logit and Nested Logit). All of these differences muddle study comparisons; in particular, they obfuscate the comparison of parameter estimates from study to study.

2.1. Travel distance variables

The distance between tourists' starting-out points and their destinations can be measured in various ways, e.g. Euclidean distance, road distance, cognitive distance or travel time in hours or minutes (Nyaupane & Graefe, 2008). The notion that choice of transport mode is dependent on travel distance is neither remarkable nor controversial, irrespective of the particular measurement (Scheiner, 2010). In this regard, a number of prior transportation studies have shown that as the total time spent in any given transportation mode increases, the probability of that mode being chosen decreases (Asenio, 2002; Bhat, 1998; Commins & Nolan, 2011; Hess, Adler, & Polak, 2007; Salon, 2009). Two studies also show that this fits the tourism context (Can, 2013; Kelly et al., 2007). Bearing the diversity of these studies in mind, people and tourists alike seem to opt for the most time-efficient mode of transportation if that opportunity is available. Against this background, other research results make intuitive sense. For example, Limtanakool, Dijst, and Schwanen (2006) reported that an increase in absolute travel time by car increased the probability of a person traveling by train (as opposed to car) when going on medium and long-distance leisure trips. In a similar fashion, Nerhagen (2003) found that as tourists' travel distances increased so did the probability of rail travel as opposed to road. Finally, among Dutch tourists, Middelkoop et al. (2003) observed that in the case of long-distance travel air transportation was favored at the expense of traveling by car. On the whole, these observations imply that travel distance variables have an important bearing on the transportation mode choices of Norwegian tourists. Physical travel distance in kilometers and travel distance in hours are the two measures of travel distance used in this study.

2.2. Trip-related characteristics

Trip-related characteristics include variables such as length of stay, travel party size, purpose of trip, type of accommodation, destination attributes, travel activities participated in, and so on. Generally speaking these features all appear to be interrelated, albeit in varying degrees (Middelkoop et al., 2003; Woodside & Dubelaar, 2002). In this study, an underlying premise is that these trip-related characteristics are drivers of choice of transportation mode (Barros, 2012; Becken & Schiff, 2011; LaMondia et al., 2010). In other words, it is assumed that variation in tourists' trip-related characteristics – in short, trip complexity – will bring about "variation" in their choice of transportation mode. For example, the purpose behind certain trips (as opposed to others) and/or an extended length of stay could point to the choice of private car over air transportation, whereas other trip-related characteristics might suggest a completely different mode. Trip-related characteristics or trip complexity being causally prior to transportation mode choice, however, is by no means necessarily obvious (Scheiner, 2010). Still, extant research seems to indicate that it is trip complexity that drives transportation mode decisions and not the other way around (Li, Wang, Yang, & Jiang, 2013; Ye, Pendyala, & Gottardi, 2007). In much the same manner as for travel distance variables, this study proposes that certain trip-related characteristics will influence Norwegian tourists' in their choices of transportation mode. The trip-related attributes used in the study are length of stay in days, travel party size, number of counties visited on the trip, type of destination visited (i.e. an urban–rural dimension), purpose of trip and number of travel companions.

2.3. Socio-demographic variables

Some studies have touched on how the socio-demographic profile of tourists influences the transportation mode choices they make (Can, 2013; Kelly et al., 2007; Masiero & Zoltan, 2013; Nerhagen, 2003; Tasur & Wu, 2005). The general impression from this research is that socio-demographic features – often in the guise of control variables accounting for differences in preferences – generally do not appear to be important determinants of tourists' transportation mode choices. Two exceptions in this regard might be the variables age and income (Bhat, 1998; Tasur & Wu, 2005). Age, household income and gender are the socio-demographic variables utilized in this study.

3. Model development and econometric methodology

3.1. Model development

A number of more invariant features could affect the transportation mode choices of tourists. In Section 2 it was suggested that three particular sets of independent variables or regressors would influence Norwegian tourists' long-distance transportation mode choices (*TMC*) — private car, air transportation and public transportation. Hence, the formal model underlying the present study can be written as

$$TMC = \mathrm{f}(TD, TRC, SDV),$$

where *TD* indicates two travel distance variables (i.e. in kilometers and hours), *TRC* a vector of trip-related characteristics and *SDV* a vector of socio-demographic variables. In general terms, therefore, the aim of this study is to show how these determinants statistically explain the long-distance transportation mode choices of Norwegian winter tourists.

3.2. Econometric methodology

There are several models available for linking a set of transportation alternatives such as those outlined in Section 3.1 with a set of independent variables or regressors (see Ben-Akiva & Lerman, 1985; Long, 1997; Train, 2003). In the present context, however, the choice boils down to the Multinomial Logit (MNL) model or the multinomial probit (MNP) model. There are three a priori reasons for this: (1) The