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Research Article

Tourists' Transportation Mode Choices by Conditional and Mixed Logit Models

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Abstract

Modelling of tourists' transportation mode choices has received scant attention from academics. The present study adds to the existing research with an examination of how three different aspects of utility -cost-efficiency, time-efficiency and flexibility - as well as certain trip-characteristics and socio-demographic variables affect these choices. Based on a survey tapping information on tourism behaviour and using conditional logit and mixed logit models, three main findings are presented: All three utility dimensions have the expected effects on transportation mode choices, with cost-efficiency being the most important. The utility dimensions have greater explanatory power regarding tourists' transportation mode choices than trip-characteristics and socio-demographic variables. Overall, the models have greater predictive power of transportation mode choices than what appears to be the norm in previous research. The empirical setting is the summer vacation trips taken by a sample of Norwegian students. Some implications for future research are provided.

Keywords: Conditional Logit Model; Mixed Logit Model; Transportation Mode Choices; Tourists

JEL classification: C25; Z3; Z32

Introduction

Variation aptly describes people's transportation mode choices, and two of its sources are utility evaluations and preferences. That is, people base their transportation mode choices on the subjective utility they ascribe to the various alternatives available to them and to other more invariant features influencing their preferences, such as socio-demographic variables, personal values and psychological traits [1]. An abundance of transportation modelling studies, embedded in Lancaster's (1966) [2] at-the-time new consumer theory or Domencich and McFadden's (1975) [3] early empirical travel mode analyses, have had this premise as point of departure. However, most previous studies have focused on commuting and related transportation mode choices people make in their everyday lives.[1] In contrast, much less research has examined how tourists choose between different modes of transportation to reach their destinations [4,5]. Against this background, the aim of the present study is to add to what is scant knowledge of the determinants of variation in tourists' transportation mode choices.

More specifically, this study examines how certain utility dimensions, trip-related characteristics and socio-demographic variables explain the variation in tourists' transportation mode choices. In terms of estimation, the study uses the conditional and so-called mixed logit (and probit) model in explaining the transportation choices of a sample of Norwegian students on a vacation trip during the summer of 2014.

The upcoming section (2) reviews most of the relevant prior research, whereas the subsequent section (3) describes the study purposes in more detail. Section 4 presents the data and section 5 the econometric methods and the results, whereas section 6 concludes.

Prior Research

Although neither general transportation researchers nor tourism academics have devoted much attention to the transportation choices of tourists, this does not mean that there are no theories or prior studies shedding light on the determinants of such choices. Consider tourist *i* facing a choice on how to reach his or her vacation trip destination. Suppose further, for simplicity, that *i*'s only available alternatives are traveling by car or by air. In this setting, it is likely that the choice will be based on the subjective utility *i* ascribes to the alternatives as well as *i*'s more permanent preferences for either option. In other words, a transportation mode choice in a tourism setting, as in general, is often a function of utility assessments on the one hand and more stable preferences on the other. Against this background, Nerhagen (2003) [6] used a mixed logit model to examine how certain utility evaluations and socio-demographic variables and trip-related characteristics (i.e. proxies for preferences) affected the choice Swedish tourists had to make between car and rail transport. More recently, but in a similar fashion, Can (2013) [7] used a multinomial probit model to scrutinize how several utility assessments and socio-demographic and locational variables affected the transportation mode choices of tourists traveling in Vietnam. Using a so-called nested logit approach, Kelly et al. (2007) [8] studied how analogue determinants affected the sequential transportation mode choices of tourists to Whistler, British Colombia. In this regard, the first choice (1) was private versus public transportation and then, given a public choice in (1), the choice between (2) bus and train. Finally, Thrane (2015), [5] using a multinomial logit model, showed how travel distance variables, trip-characteristics and socio-demographic variables, but not utility dimensions, explained a fair share of the variation in Norwegian winter tourists' transportation mode choices.

The type of independent variables or regressors used in the above tourism studies, as well as in the general transportation literature, tend to fall within two main categories: alternative-specific and case-specific regressors. To simplify somewhat, the former largely correspond to the various utility aspects of the available mode choices: cost-efficiency evaluations, time-efficiency assessments and similar judgments regarding quality, flexibility and convenience issues. In contrast, the case-specific regressors, functioning as proxies for preferences, comprise the more invariant characteristics of the tourists, such as socio-demographic variables, stable personality traits and trip-related characteristics.[2] As for the utility dimensions, the literature has clearly given most attention to travel cost and travel time. A number of studies have shown that the higher the travel cost (or the price) of the transportation mode in question, the less likely it is that this mode is chosen. That is, a higher travel cost lowers utility and reduces demand [7-11]. The same basic logic applies in the case of time spent in a particular transportation mode: as time increases, the likelihood of that mode being disregarded increases too [1, 7-11] These effects might also lead to switching behaviour or substitution effects [12], such as when traveling by car is preferred to a more expensive train trip when travel times are about equal. Other utility aspects are convenience, flexibility and quality (e.g. comfort, luxury, etc.). In the extant literature, however, the effects of these factors are neither as strong nor as unequivocal as for travel cost and travel time [7].

The case-specific regressors in the tourism transportation literature fall within four main categories according to Thrane (2015) [4] : (1) socio-demographic variables (e.g. gender, age, education and income, etc.), (2) psychological factors (e.g. personal values, attitudes and personality traits, etc.), (3) travel distance variables, and (4) trip-related characteristics (e.g. length of stay, trip purpose/ motives, type of accommodation, type of destination). Among these, trip-related features and distance variables seem to have the most predictive power [4]. Yet it is unclear from extant research which of the two main types of regressors - the alternative-specific or the case-specific - is the most salient from an explanatory power point of view.[3] Previous transportation mode research has used a number of different econometric methods [13]. The choice of method depends on the regressors in question (alternative-specific, case-specific, or both), the data considered (stated or revealed preference),[4] the number of transportation modes (two or several) and on any possible sequencing of choices (yes or no). Excluding the binary choice models (i.e. logit or probit), the most typical methods are the multinomial logit model, the conditional logit model, the mixed logit model and the nested logit model [14,15]. There are also probit versions of these models, in which the so-called IIA assumption is relaxed (more on this in section 5). It is difficult, if not impossible, with this excess of estimation methods available to make strict comparisons between studies. Differences in sample designs, empirical contexts and in the operationalization of key regressors even further inhibit parameter comparisons across study.

The Present Study

A number of alternative-specific utility assessments may come into play when tourists evaluate the possible transportation modes for getting to their respective destinations. The present study considers three of these: cost-efficiency, time-efficiency and flexibility. Based on the studies cited above, the general expectation or hypothesis guiding the research is that tourists in general act rationally to maximize their subjective utility and thus choose the mode of transportation that is most cost-efficient, time-efficient and flexible. Given the fact that students tend to be budget-conscious, cost-efficiency is expected to be the most important of the three utility dimensions in terms of explanatory power [16]. As for the case-specific regressors in the study, two of Thrane's (2015) [5] four categories are relevant due to the availability of data: (1) trip-related characteristics and (2) socio-demographic variables. More specifically, the regressors in question are the destination for the trip, Length of Stay (LOS), travel companions, age and gender. All of these have been used extensively in previous tourism transportation research [4,5,7,17-19]. The general proposition guiding the study, thus, is that these regressors individually and combined have ample explanatory power regarding students' transportation choices.

Summing up, the present study aims to examine how certain utility dimensions (cost-efficiency, time-efficiency and flexibility), trip-characteristics (trip destination, LOS, and travel companions) and socio-demographic variables (age and gender) explain variation in the transportation mode choices of students. The three alternatives in question are private car, air and public transportation. It is hypothesized that all three utility dimensions affect transportation mode choices but that cost-efficiency is the most prominent. Finally, the study seeks to assess whether or not the alternative-specific regressors (i.e. the utility dimensions) are more salient than the case-specific regressors (i.e. trip-related characteristics and socio-demographic variables) in terms of explaining variance in students' transportation mode choices. The data, variables and descriptive statistics are presented in the next section.

Data, Variables and Descriptive Statistics

Survey and Sample

The data stem from a survey carried out at a medium-sized Norwegian university college during November and December 2014. The standard intercept-around-campus approach was deemed inappropriate towards ensuring a high response rate and a sample sufficiently large for complex multivariate analysis. Instead, course instructors for first and second-year students of the various study programs distributed and collected the questionnaires during their regular classes. One part of the questionnaire covered background variables (e.g. gender, age, college experience, financial situation, paid work obligations during summer, etc.). The other asked about the specific contents (i.e. trip-characteristics) of the vacation trip of longest duration taken in the period 1 May to 15 August 2014, with questions about the transportation mode chosen as well as not chosen. The questions on the three available modes of transportation - private car, air and public - was completed by 240 students (excluding missing values), yielding 720 observations for analysis (240 × 3 = 720).

Alternative-specific Regressors - Descriptive Statistics

For each of the three available modes of transportation, i.e. the one chosen and the two not chosen, the questionnaire asked: "On a scale from 1 to 7, how would you rate the transportation mode private car/air/public transportation in terms of cost-efficiency? (1 = to little extent; 7 = to great extent)" and ditto for time-efficiency and flexibility. Table 1 presents descriptive statistics for these three alternative-specific utility regressors. We note that the students in the sample evaluated cost-efficiency and time-efficiency as equally important, and that flexibility was the most important utility dimension.

	Mean	SD
Cost-efficiency	3.54	2.11
Time-efficiency	3.55	2.43
Flexibility	3.71	3.71

Table 1: Descriptive statistics for alternative-specific utility regressors.

Case Specific Regressors - Descriptive Statistics

Table 2 suggests that almost two-thirds (63%) of the trips were to foreign destinations, and that the average Length of Stay (LOS) was about 9 days. Most of the students travelled with a companion (77%), and the average age of the students was 22 years. About 70% of the students were female, reflecting the overall gender composition of the university college in question.

	Mean	SD
Destination (foreign trip = 1; domestic trip = 0)	0.629	0.483
Length of stay in days (LOS)	9.28	7.28
Travel companions (alone = 1; other = 0)	0.129	0.336
Age in years	22.16	4.32
Gender (female = 1; male = 0)	0.696	0.460

Table 2: Descriptive statistics for case-specific regressors.

Dependent Variable

As mentioned, the three transportation modes given in the questionnaire were by private car, by air or by public transportation. In the estimation sample, 35% of the students opted to travel by car, 57% preferred air travel, whereas the remaining 8% chose some form of public transportation. The percentage of students preferring air transportation is in agreement with that in previous research [16] despite the fact that this is the pricier alternative in many cases. In the present setting, however, this could also reflect the high proportion of long-distance foreign travel in the sample. The next section presents the econometric models and the results.

Econometric Models and Results

Two models appear in the first sections of the multivariate analyses. The first model (Table 3), in which only the alternative-specific regressors are included, is the standard conditional logit model [5,14] The second model (Table 5), which also includes the case-specific regressors, is the so-called mixed logit model [5,14]. Yet since the "asclogit" command in Stata (version 13.1) subsumes both of these models under the same estimation procedure, they are comparable in terms of explanatory power [15]. Robust standard errors are reported throughout the analyses. An issue worthy of attention in transportation choice modelling using logit models is the consideration of the irrelevant alternatives assumption (IIA). In this regard, a logit model's validity is contingent on the IIA assumption not being violated; in contrast, the similar probit model relaxes this assumption [5,14,15] To verify the mixed logit model's results, thus, Table 6 reports the results of the analogue mixed probit model (i.e. the "asmprobit" command in Stata).

Results A: Alternative-specific Regressors Only - The Conditional Logit Model

Table 3 presents the results of the conditional logit model. The first thing to note is that the three alternative-specific utility dimensions explain almost half of the "variation" in transportation mode choices (Pseudo R-squared = 0.492). This suggests that, combined, they are vital determinants of transportation choice. Second, all three utility dimensions have positive and significant effects on transportation mode choice. This implies that irrespective of the mode actually chosen, if the subjective utility of any of these three utility-bearing aspects increases, so does the probability of a particular mode being chosen; or, conversely, if utility decreases, the likelihood of a particular mode not being chosen also increases. Third, since the three utility-bearing dimensions have the same measurement scale and the multivariate model warrants a *ceteris paribus* interpretation, the magnitude of the coefficients indicates relative importance. Therefore, student tourists appear to base their transportation mode choices primarily on cost-efficiency assessments, followed by time-efficiency and flexibility assessments.[5] This is in line with the findings of Hergesell and Dickinger (2013) [16] and Can (2013) [7].

	b	Robust SE	z-value	p-value
Base alternative: Car				
Alternative-specific regressors:				
Cost-efficiency	0.447	0.083	5.41	< 0.001
Time-efficiency	0.289	0.076	3.78	< 0.001
Flexibility	0.171	0.066	2.59	0.010
Constant: Air transportation	0.432	0.354	1.22	0.222
Constant: Public transportation	-0.689	0.331	-2.08	0.038
Log likelihood (intercept)	-211.664			
Log likelihood (model)	-107.613			
Pseudo R-squared	0.492			
N (cases)	240			
N (observations)	720			

Table 3: Transportation mode by alternative-specific regressors. Conditional logit model.

Taken as a whole these results support the well-known notion that less utility brings about less demand, and that more utility increases it [11]. Also supported is the initially stated expectation that cost-efficiency is the most salient of the three utility dimensions considered. That said, the reported logit coefficients do not shed much light on how, say, a marginal increase in any of the 7-point utility scales affects the probability of a transportation mode being chosen (Long, 1997). Table 4 answers this question more precisely. Since the marginal effects differ with respect to the transportation mode actually chosen, Table 4 presents the full set of effects. Panel A displays the results given the choice of private car. We note that a unit increase in cost-efficiency for car transportation brings about a 9.3% increase in the probability of a car being chosen. In other words, a 3-point increase in cost-efficiency - say from 3 to 6 on the 7-point scale - means the car is 28% more likely to be chosen, *ceteris paribus* ($9.3 \times 3 = 27.9$). Also, a unit increase in cost-efficiency for car transportation means an 8.5% reduction in the probability of air transportation being chosen and a 0.7% reduction in public transportation. This suggests that the real choice - or substitution pattern - for the student tourist in question is between a private car and air transportation. For time-efficiency, a unit increase in utility is associated with a 6% increase in the probability of a car being chosen, underscoring the notion that this utility dimension is not quite as important as cost-efficiency. This is also reflected in that the corresponding probability reductions for air and public transportation are less than they are for cost-efficiency. Again, we note that student tourists appear to choose mainly between private car and air transportation. Finally, a unit increase in flexibility brings about a 3.5% higher probability of car transportation and a 3.2% reduced likelihood by air. Panels B and C present the analogue figures given a choice of air transportation and public transportation. In the main, and as expected, these findings mirror those of Panel A. The smaller marginal effects in Panel C accentuate the notion that the student tourists in question typically choose between private car and air transportation when they embark on summer vacation trips.

	Cost-efficiency	Time-efficiency	Flexibility
Panel A: Car choice			
Mode: Car	0.093	0.060	0.035
Mode: Air	-0.085	-0.055	-0.032
Mode: Public	-0.007	-0.005	-0.003
Panel B: Air choice			
Mode: Car	-0.085	-0.055	-0.033

Mode: Air	0.102	0.066	0.039
Mode: Public	-0.016	-0.011	-0.006
Panel C: Public choice			
Mode: Car	-0.007	-0.005	-0.003
Mode: Air	-0.016	-0.011|	-0.006
Mode: Public	0.024	0.015	0.009
Note: In calculating the marginal effects of each alternative-specific regressor, the other regressors are set at their sample means. Marginal effects are based on the model reported in Table 3.			

Table 4: Transportation mode by alternative-specific regressors. Marginal effects.

Results B: Alternative-specific and Case-Specific Regressors - The Mixed Logit Model

Table 5 presents the results of the so-called mixed logit model. Compared with the strictly alternative-specific model in Table 3, the first thing to note is that all three utility aspects (i.e. cost-efficiency, time-efficiency and flexibility) continue to have positive, important and statistically significant effects on transportation mode choice even when the case-specific regressors are controlled for. Yet flexibility appears more important in relative terms once the case-specific regressors are included in the model. That is, the mixed logit model puts time-efficiency and flexibility as equally important determinants of student tourists' transportation choices, but neither of them appears quite as important as cost-efficiency.

The second thing worth noting is that the mixed logit model, as expected, fits the data better (Pseudo R-squared = 0.690) than the plain conditional logit model (Pseudo R-squared = 0.492). More precisely, the added explanatory power resulting from inclusion of the case-specific regressors in the model is about 40% ((100/0.492) × (0.690 - 0.492) = 0.402). This suggests that the case-specific regressors by themselves are relevant determinants of student tourists' transportation choices, although not as important as the alternative-specific regressors. In other words, utility assessments appear to overshadow preferences. Compared with prior research, both the conditional and the mixed logit model in this study are impressive in terms of explanatory power. In most cases that could be compared meaningfully with the present one, the similar measures of model fit seldom exceed 0.40 [7,20,21]. There are several significant effects of the case-specific regressors. In this regard, the 'Air transportation' column contrasts with private car use. The positive sign for the foreign country coefficient thus suggests that trips to such a destination, relative to domestic trips, are more likely by air than by private car. Expressed in terms of a probability difference (i.e. the marginal effect), trips to foreign countries are 74% more likely to be made by air than by car. (See Long and Freese (2014) [15] on how to calculate marginal effects.) The relationship between Length of Stay (LOS) and the choice between car and air transportation has an inverted U-form. That is, for trips lasting less than about 15 days, an increase in LOS entails a raised probability of air transportation being used. For stays exceeding 15 days, in contrast, staying one more day at the destination in question is associated with an increased likelihood of car transportation. Older student tourists are more likely than younger students to travel by air relative to car - one additional year increases the probability of air transportation by 5%. In much the same vein, females more often prefer air transportation to traveling by car - the exact gender difference being 31%. For the 'Public transportation' column, only one of the regressors has a significant effect, underscoring again how the "actual" choice for the student tourists in the sample is between car and air transportation. That said, however, student tourists traveling alone have an increased likelihood of opting for public transportation compared with those traveling in groups, relative to private car transportation.[6]

	b	Robust SE	z-value	p-value
Base alternative: Car				
Alternative-specific regressors:				
Cost-efficiency	0.447	0.096	4.67	< 0.001
Time-efficiency	0.247	0.084	2.95	0.003
Flexibility	0.266	0.107	2.48	0.013
	Air transportation		Public transportation	
Case-specific regressors:	b	Robust SE	b	Robust SE
Destination:[a]				
Foreign country	3.94***	0.746	0.831	0.862
Length of stay (LOS)	0.455***	0.128	0.063	0.110

LOS-squared	-0.015***	0.003	-0.002	0.003
Travel alone (yes = 1; no = 0)	1.35	1.42	2.82**	1.03
Age (in years)	0.246*	0.105	0.059	0.122
Gender:[b]				
Female	1.45*	0.641	0.758	0.790
Constant	-10.4	2.29	-3.46	2.74
Log likelihood (intercept)	-211.664			
Log likelihood (model)	-65.525			
Pseudo R-squared	0.690			
N (cases)	240			
N (observations)	720			
[a]Domestic (i.e. Norwegian) trip = reference category. [b]Male = reference category. * p < .05** p < .01 *** p < .001				

Table 5: Transportation mode by alternative-specific and case-specific regressors. Mixed logit model.

The Results' Robustness – The Mixed Probit Model

As stated earlier, the mixed probit model relaxes the so-called IIA assumption of the mixed logit model and may thus be used to check if a violation of this assumption distorts the results reported so far. The clear impression from Table 6 is that this does not appear to be the case. On the contrary, the signs and significance levels of the coefficients are similar for the mixed logit and mixed probit model. That the coefficients differ in magnitude between the two models - the coefficients for the logit model generally being greater - is likely attributable to only how the two models are scaled [15]. In terms of the marginal effects, however, the two models yield substantively similar findings (results available on request).

	b	Robust SE	z-value	p-value
Base alternative: Car				
Alternative-specific regressors:				
Cost-efficiency	0.326	0.066	4.95	< 0.001
Time-efficiency	0.185	0.061	3.02	0.003
Flexibility	0.207	0.070	2.96	0.003
	Air transportation		Public transportation	
Case-specific regressors:	b	Robust SE	b	Robust SE
Destination:[a]				
Foreign country	3.05***	0.492	0.598	0.549
Length of stay (LOS)	0.343***	0.091	0.065	0.081
LOS-squared	-0.011***	0.002	-0.002	0.002
Travel alone (yes = 1; no = 0)	0.933	0.891	1.99**	0.696
Age (in years)	0.193**	0.066	0.043	0.043
Gender:[b]				
Female	1.06*	0.441	0.693	0.544
Constant				
Log likelihood (intercept)	-211.666			
Log likelihood (model)	-65.921			
Pseudo R-squared	0.689			
N (cases)	240			
N (observations)	720			

[a]Domestic (i.e. Norwegian) trip = reference category. [b]Male = reference category. * p < .05** p < .01 *** p < .001

Table 6: Transportation mode by alternative-specific and case-specific regressors. Mixed probit model.

Summary, Discussion and Implications

Compared with the large number of studies modelling the transportation mode choices of people in their everyday lives, similar modelling efforts of tourists' choices are few and far between in the literature. Against this state of affairs, the present study contributes to the small but growing tourism transportation literature. Based on knowledge from the general transportation literature and from some previous tourism applications in this regard, the study has examined how certain utility dimensions, trip-characteristics and socio-demographic variables affected the transportation mode choices of a sample of Norwegian students embarking on summer vacation trips in 2014. The most important findings are presented and commented on below.

The three utility aspects of cost-efficiency, time-efficiency and flexibility had the expected effects on transportation mode choices. Cost-efficiency was the most important in a comparative sense. In general, these findings make intuitive sense seen up against similar observations in prior research [5,7,16]. In terms of policy, the results underscore the well-known insight that utility assessments influence economic behaviour; for example, how a price reduction brings about an increase in demand. The longer tourists travel in km, the more likely it is that they will opt for air transportation rather than private car [5,19] In light of this general observation, the present finding that student tourists, to an overwhelming extent, prefer air to car transportation when traveling abroad intuitively makes sense. This is also in line with the notion that tourists and others alike tend to opt for the most time-efficient means of transportation given the opportunity to do so [5]. The combined results regarding cost-efficiency and time-efficiency imply the need for drastic policy interventions if substitution is the objective. That is, if people are to switch from air to car transportation, airfares will most likely have to increase dramatically, gasoline prices plummet, and road quality improve dramatically. This is probably not a very realistic scenario, for obvious reasons.

Regarding Length of Stay (LOS), Thrane (2015) [5] noted that longer durations increased the probability of travel by air transportation rather than by car. Becken and Schiff (2011) [17], by contrast, observed the opposite pattern. In the present study, the result is midway between these studies in the sense that there is a positive relationship between LOS and air transportation preference for trips lasting less than 15 days – akin to Thrane (2015). For trips of longer duration than 15 days, however, the results of the present study are in line with those of Becken and Schiff (2011). The final trip-related characteristic in the present study was travel companions. The finding here was that student tourists traveling alone more often opted for public transportation, relative to car. In other words, student tourists traveling with someone else were the most typical private car mode choosers. This mirrors the finding of LaMondia et al. (2010) [18] and probably reflects how traveling alone by car is cost-inefficient and/or that making travel reservations is less cumbersome if traveling alone. Regarding the socio-demographic variables, both age and gender were significant predictors of the choice between car and air transportation. Yet since neither of these variables, with the possible exception of age [1], has had any important effect on transportation mode choices in previous research, the present study's findings should be deemed as tentative. They could also very well reflect that the sample in question here is more homogenous than the typical sample analysed in the literature to date. Further research is thus needed here. The Norwegian students analysed in this study did not make much use of public transportation when going on vacation trips, much in the same manner as was found for the general population of Norway [5].

From a sustainability perspective, [22] this is very bad news or just plain bad news, depending on one's perspective. Taking the latter, the results imply there is ample room for improvement in use of the more environmentally friendly public transportation mode. But in order to reach this goal two related conditions must be met. First, prospective tourists' utility assessments regarding public transportation have to increase and, second, for such an increase to occur, more frequent and faster public transportation at affordable prices would probably be needed. Another requirement would perhaps be a cost surcharge for car and air transportation. As such, there might be justification for both the "carrot and the stick".

Previous transportation choice studies differ in many ways. It is thus difficult to assess whether differences in results between two given studies reflect actual idiosyncrasies or are methodological artefacts. Conversely, if two studies show that a specific regressor has the same effect on the propensity to choose, say, private car over air transportation, it is not easy to assess whether this reflects a true relationship or just methodological serendipity. It follows from this that interpretations and explanations of statistical relationships rest as much on sound judgment as they do on the findings in previous research. Bearing this in mind, the findings of the present study still appear reasonable. Obviously, however, given the homogeneous nature and moderate size of the sample analysed, more research on larger and more heterogeneous tourist samples is clearly needed before any definitive conclusions can be drawn. In this regard, the question of certain regressors' potential endogeneity should also be addressed. Consider, for example, Length of Stay (LOS) or Destination Choice (DC). The behavioural model underlying the present and similar studies' use of discrete choice models assumes that the decisions of LOS and DC are taken *before* the decision on transportation mode. If this assumption is plausible, which it might very well be, there is no danger of endogeneity. However, another possible scenario could be that the LOS/DC decision is made simultaneously with the transportation mode choice [23]. If this is the case, LOS/DC would be endogenous, and the model would thus suffer from misspecification. Future research should address this further.

These considerations aside, the present study makes three important contributions to the transportation choice literature. First, it brings together the general and the more tourism-specific literatures on the determinants of transportation mode choices. Second, it is a first attempt to compare the effects of alternative-specific and case-specific regressors in terms of explanatory power regarding tourists' transportation mode choices. Third, it presents econometric models showing greater explanatory power than does the bulk of previous research.

Footnotes:

[1]A comprehensive review of this research is beyond the scope of this paper; see Commins and Nolan (2011) [24] for a presentation of many important works. Since it is questionable whether the determinants of everyday travel decisions generally carry across to the present non-ordinary tourism setting [25], studies from the general transportation literature are cited in a more eclectic fashion.

[2]From a questionnaire-design point of view, alternative-specific regressors entail that a utility evaluation must be made by the tourist for *every* transportation mode available in the choice set, and not just for the actual choice he or she made.

[3]Technically, this means that no study to date has compared a model containing only alternative-specific regressors to a model with only case-specific regressors in terms of explanatory power.

[4]Stated Preferences (SP) and Revealed Preference (RP) data have different strengths and weaknesses. Since SP data involve hypothetical data (i.e. choice experiments), an important but open question is whether choices in the real world correspond with stated intent [26].

The problem with RP data (e.g. a survey tapping information on actual behaviour) is that information on non-chosen transportation modes is not usually available (but see note 2), and that it can be difficult to obtain reliable measures for the important price variable [10].

[5]The cost-efficiency coefficient (0.447) is also significantly larger than the flexibility coefficient (0.171) at $p < 0.01$.

[6]None of the regressors in the mixed logit had VIF-scores higher than 2.04 except for LOS and LOS-squared. This suggests that multicollinearity, often a common problem in these kinds of models, was of no conce

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