Time at destination and transportation mode: a discrete-continuous choice approach to Swiss tourism demand.

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Time at destination and transportation mode: a discrete-continuous choice approach to Swiss tourism demand.

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Abstract

Despite scientific literature on the relationship between tourism and transport is wide (Alegre and Pou (2006), very few studies take into account the interdependence between time at destination and transportation mode, given the origin and the destination of the trip. The purpose of this paper is to investigate how the length of permanence at destination depends on a specific mode of transport and vice versa.

We implement a discrete-continuous choice model (Hanemann (1984) and Dubin and McFadden (1984)), which is typically applied when the optimal discrete choice depends partially on the result of the continuous choice. For instance, the implementation of the discrete continuous choice models allows modelling jointly the discrete and the continuous consumer choices from the same utility maximisation problem.

The present work is based on a dataset in which information about the behavior of Swiss tourists is collected. Information regards type of destination, type of origin, transport mode (Martin and Witt, 1988) and travel expenditure (Song and Li, 2010) and these elements are the focus of our work. This study represents the first case in which a discrete continuous choice model is applied to Swiss tourism data.

Our preliminary results confirm, as we expected, that tourists from both periphery and rural area tend to move by private transportation to reach their holiday destination. On the other hand, the public transport seems to be preferable, if the destination is a holiday at seaside. Moreover, the model points out that when the number of travellers increases, the probability of choosing public transportation decreases. This result might be driven by the fact that the marginal cost per an extra person for the private transportation is null, whereas for the public transportation is positive.

In tourism literature, duration of the journey and the transportation mode are generally chosen as the main explanatory variables of tourism demand. In this study, we change the perspective in the sense that we want to analyse the link among them and how it influences the tourism demand.

Keywords

Tourism mobility, Length of stay, Transportation mode, Discrete-Continuous choice model

1. Introduction

When tourists organize a trip, a number of decisions must be taken into account such as the type of destination, the transportation mode and the type of accommodation. Although decisions about vacation can be seen as a sequence of steps, their main characteristic is their interdependence (Alegree, Lorence, (2006)). The holiday time, like the actual decision to choose e.g. private or public transport, are mainly related to both personal and family characteristics of the tourists. The social characteristics variables that determinate the length of stay are the tourist's age, the family status, children on trip, level of education and profession. Some of these have a direct influence on the choice of the means of transport. For instance, the presence of children leads tourists to choose a more comfortable transport to reach their destination. In addition, the economic aspects such as her/ his income level, the price of the holiday and the cost of accommodation influence the stay at destination.

The purpose of this research is to exploit the link between time and type of transport and how it influences the tourism demand. In our work we exploit the discrete-continuous choice model (Hanemann (1984) and Dubin, McFadden (1984)) to the Swiss touristic travels by considering as means of transport both private and public transportation and how their choice influences the duration of the journey and vice versa.

2. Literature review

Decisionmakers often face the situation of making two interrelated choices. "*If in each choice the decisionmaker faces a finite and exhaustive set of mutually exclusive alternatives, the qualitative choice models can readily be applied to describe the two choices.*"(Train (1986)). In many situations, however, the decisionmaker has to choose among choices that are both not "qualitative". For example, a tourist may decide whether to spend a holiday at the seaside or in the mountain, as well as how many days spend on vacation; a tourist may decide whether to buy a second house or not, as well as how far is it from his / her own one. In all of these cases, the optimal discrete choice partially depends on the result of the continuous choice and vice versa.

For instance, the implementation of the discrete continuous choice models allows modelling jointly the discrete and the continuous consumer choices from the same utility maximisation problem. Hanemann (1984) and Dubin and McFadden (1994) estimate the discrete continuous choice in two steps, as do Bernand, Bolduc and Belanger (1996). Mannering and Winston (1985)) and de Jong (1990) analyse the simultaneous determination of private car ownership and private car use.

Discrete-continuous choice models are also used to study whether or not participating in tourism activity has an effect on tourism expenditure decision (Wu, Zhang, Fujiwara (2013)) or choosing to go on holiday and how long stay at destination.

In literature, different factors are taken into account to analyse the phenomenon of length of stay: nationality, age, level of education and labour status (Oppermann (1995, 1997); Seaton, Palmer (1997); Sung, Morrison, Hong and O-Leary (2001)). Oppermann (1995) also points out that change in the family unit may affect directly the duration of the journey and this is due to the tourist's choice of holiday destination. In relation to the latter, Gronau (1970) shows that the existing distance between the tourists's residential area and their holiday destination (i.e. the travel distance) might positively affect the length of stay. Hence, travel distance is a useful variable to predict travel demand. For example, distance relates to infrastructure requirements, transportation cost and accessibility to public transport. Tourists, like other customers, react to changes in price of transport e.g. how far people travel (Liddle (2009)), where they acquire fuel, and what kinds of vehicles or modes they choose to reach their destinations.

3. The model

The analysis follows a two-stage design: in the first part a model for the discrete choice among alternative means of transport is estimated. The second part is a model of the number of days spent at destination (the continuous variable) in which the results from the first stage are used in order to correct for the simultaneity of the choice of transportation mode.

A tourist is supposed to choose an option between two alternatives $J = 1,2$ for getting to his/her holiday destination. The choices are either private or public transportation mode: the alternative private transport considers car, caravan and camper, whereas the public transport includes bus, train, airplane and taxi. For instance, a tourist i choose the alternative j as well as how much time to spend at the destination T_i.

The utility U_j^* from selecting transport j among a finite choice set of m alternatives is:

$$U_j^* = \beta_j x + \varepsilon_j \;\; j = 1,2 \quad (1)$$

Where x denotes both the set of explanatory variables and the attributes of the alternative, β_j the unknown coefficients, and ε_j the error term. The latter accounts for unobserved characteristics influencing the selection of transport.

The second component of the model estimates the time at destination T_i. For the chosen transportation service j the conditional demand for time T_i is as follows:

$$T_i = \gamma_i z + \omega_i \;\; i = 1 \dots n \qquad (2)$$

z are the explanatory variables influencing the conditional demand for the time (the continuous variable), ω_i is the error term with expected value $E(\omega_i|z,x) = 0$ and variance $V(\omega_i|z,x) = \sigma^2$.

With respect to the transportation choice model, it can be assumed that the tourist is observed to have chosen the alternative j in order to maximize her/his utility from all alternatives such that $U_j^* > U_k^* \,\forall\, j \neq k$.

For instance, the choice probability P_j, may be expressed as:

$$P_j = Pr\left(\beta_j x + \varepsilon_j \geq \beta_k x + \varepsilon_k, all\; j \neq k\right) = Pr\left(\varepsilon_j - \varepsilon_k < \beta_j x - \beta_k x, all\; j \neq k\right) \;(3)$$

Assume that disturbance ε_j is identically and independently distributed across alternatives and tourist and that it follows the extreme value distribution $\varepsilon_j \sim EV(0,\mu)$.

The probability that alternative j is chosen then thakes the well-known multinomial $logit$ (MNL) form

$$P(j|m) = \frac{e^{U_j}}{\sum_{j=1}^{m} e^{U_j}} \quad (4)$$

P_j increases monotonically with the systematic utility of that alternative j and decreases with the systematic utility of each of the other alternatives.

The parameter vector β_j of the MNL can be easily estimated by maximum likelihood estimation. In our research the choice set $m = 2$, thus the multinomial logit model is the classical binary logit model.

The parameter vector cannot be directly estimated in the continuous equation. The disturbance term ε_j of the discrete choice model and of the conditional demand model ω_i may not be independent. The means of transport and the number of days are related decisions; unobservable factors may affect either one or the other decisions.

If these factors are correlated, the application of the ordinary least squares on the continuous equation will produce inconsistent estimates. Therefore, the conditional expectation of ω_i is not zero, but a function of the choice probabilities. In order to correct this endogeneity problem, we follow the approach by Dubin and McFadden (1984) as also suggested by Train (1986). A linearly specified selection correction term enters the continuous equation. It is specified as a consistent estimate of the choice probabilities (that is predicted probabilities from the discrete choice problem).

The coefficients γ_i can be consistently estimated with least squares from the following model

$$T_i = \gamma_i z + \sigma \frac{\sqrt{6}}{\pi}\left[\sum_{j=1}^{m} r_j \left(\frac{P_j \ln(P_j)}{1 - P_j}\right) - r_i \ln(P_j)\right] + \delta_i \quad i = 1 \dots n \; (5)$$

Where r_j is the correlation coefficient between ε_j and ω_i, δ_i is independent error term; there are (m-1) selection terms, one for each of the alternative transportation mode. In order to have consistent and asymptotically normal and efficient estimations, the final step is to estimate the variance-covariance matrix of the residuals of the model $(5), \mathbb{Q}$, and multiplied each member of the equation by $\mathbb{Q}$.

4. Data and sample description

The present study builds on a recent Household Budget survey conducted by the Federal Statistical Office (FSO) in 2010. The data collection comprises the number of trips, the participation, as well as the character of the travel and profile of the traveller. In addition, it contains day trips (i.e. day trips are over 3 hours), overnight travels, and distinguishes between private and business trips.

Our study considers 1198 private trips from 1 day up to 30 days; the average of days spent at destination is around 7.5 days. In addition to the number of days, our database contains information about the choice of the means of transport. More specifically, the Swiss tourists face two choices between private and public transportation.

The 76% choose to get their destination by private transportation, which includes car, caravan and camper whereas the 23% decides for a public service such as airplane, taxi, bus and train.

The vast majority of respondents are women (56%) and the average age is around 48 years old. The biggest share (more than 70%) of Swiss tourist live in agglomeration area, instead the rest of the responders are located between rural area and isolated city. Most represented holiday destination is *holiday at the mountain* (32%), *lake* (26%), *visiting city* (25%), and *holiday at the seaside* (17%).

5. Preliminary results

The discrete choice

In the model, the Swiss tourist faces two different transportation modes: private and public. To be able to identify the choice specific parameter, one of the alternatives has to be used as the base category; we assume the private transportation to be equal to zero.

Hereby, we present some preliminary results from the estimation of the model in the equation (5).

From the estimation of the residential area coefficient, it follows, as expected a priori, that the discrete choice model predicts lower probability toward public transport for those who live both in periphery and rural area than who reside in the city centre. On the other hand, the public transportation seems to be preferable when tourists plan on travelling to destinations located at the seaside (reference category: city centre).

As for the estimated type of holiday's coefficient, an abroad destination appears to increase the probability of selecting public transport as the way to get to holiday places.

The continuous choice

Explanatory variables in the conditional time at destination equation are gender, expenditure, type of accommodation and from the discrete choice equation the number of participants.

In order to take into account the purpose of the trip, a dummy variable, which takes value zero when the scope of trip is either visiting friends or family and 1 otherwise, is also included in the continuous equation. The duration of the journey decreases when tourists intend to meet friends or family. In contrast, the number of days is positively influenced by those tourists who choose among accommodations that might be less costly than hotel and luxury resort such as hostel, b&b, camping and so on.

The number of travellers is considered both in the discrete and continuous equation. The reason is that the number of people might affect simultaneously the decision between private and public transport and the time at holiday place. According to the results, the model shows that an increase of number of voyagers induces the choice of private transport as the way to reach the destination. In the continuous model, instead, this increase has a negative effect on the number of days.

6. Conclusions and future advances

The study aimed at shedding light on the profile of Swiss travelling tourists in Switzerland. So far, few studies take into account simultaneously the choice between transport and time. Therefore, our approach may be helpful to better understand the intentions of selecting between private and public transport and how much time spent on holiday. By contrast, our work is exploratory in a sense that we could not be able to include in the discrete choice model more alternatives specific variables that might affect the transportation decision as well as the duration of the trip. Moreover, we cannot claim to be representative of the entire population of Swiss travellers since we dispose of a survey, which provides detailed information about 2010 only. Our intention is to take into account surveys from 2008 to 2013 in order to rich source of micro-level data to complement the existing econometric model.

Concerning both the subject discussed and the methodology proposed in this paper, several advances might be adopted. From a methodological point of view, the simultaneous maximum likelihood estimation as opposed to two-step estimation may be helpful to obtain more efficiently estimations. From a conceptual point of view, several new aspects such as children on trip, level of education and the civil status might be exploited in the modelling of the phenomenon in order to achieve new evidences.

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