Switzerland mode choice

Introduction

This case study deals with the estimation of a mode choice behavior model for inhabitants in Switzerland using revealed preference data. The survey was conducted between 2009 and 2010 for CarPostal, the public transport branch of the Swiss Postal Service. The main purpose of this survey is to collect data for analyzing the travel behavior of people in low-density areas, where CarPostal typically serves. A following study proposes new public transport alternatives according to the respondents' willingness to pay for these potential services in order to increase the market share of public transport.

Data collection

The survey covers French and German speaking areas of Switzerland. Questionnaires were sent to people living in rural area by mail. The respondents were asked to register all the trips performed during a specified day and provide socioeconomic characteristics of themselves together with their households. The collected information consists of origin, destination, cost, travel time, chosen mode and activity at the destination.

1124 completed surveys were collected from respondents. For each respondent, cyclic sequences of trips (starting and ending at the same location) are detected and their main transport mode is identified. The data is used to generate the estimation database, with 1906 observations relating sequences of trips, psychometric indicators and socioeconomic attributes. It should be noticed that each observation is a sequence of trips that starts and ends at home. A respondent may have several sequences of trips in a day.

Variables and descriptive statistics

The variables are described in Table 1 and 4. A summary of descriptive statistics for each variable is given in Table 5.

Given the presence of missing data (coded as -1) an additional table summarizing the three affected variables (TripPurpose, ReportedDuration, age) after removing the missing cases is presented (see Table 6).

Table 1: Description of variables

Name	Description
ID	Identifier of the respondent who described the trips in the loop.
NbTransfertsTP1	The total number of transfers performed for all trips of the loop, using public transport (ranging from 1-9).
DureeTP1	The duration of the loop performed in public transport (in minutes).
WalkingTimeTP1	The total walking time in a loop performed in public transports (in minutes).
WaitingTimeTP1	The total waiting time in a loop performed in public transports (in minutes).
DureeAuto	The total duration of a loop made using the car (in minutes).
CoutTP1	Cost for public transports (full cost to perform the loop).
MarginalCost	The total cost of a loop performed in public transports, taking into account the ownership of a seasonal ticket by the respondent. If the respondent has a "GA" (full Swiss season ticket), a seasonal ticket for the line or the area, this variable takes value zero. If the respondent has a half-fare travelcard, this variable corresponds to half the cost of the trip by public transport..
CoutAutoCHF	The total gas cost of a loop performed with the car.
TripPurpose	The main purpose of the loop: 1 =Work-related trips; 2 =Work- and leisure-related trips; 3 =Leisure related trips. -1 represents missing values
CodageTypeCommune	The commune type, based on the Swiss Federal Statistical Office 1 =Centers; 2 =Suburban communes; 3 =High-income communes; 4 =Periurban communes; 5 =Touristic communes; 6 =Industrial and tertiary communes; 7 =Rural and commuting communes; 8 =Agricultural and mixed communes; 9 =Agricultural communes
CodageUrbainRural	Binary variable, where: 1 =Rural; 2 =Urban.
CodeClassifLignes	Classification of the type of bus lines of the commune: 1 =Centre; 2 =Centripetal; 3 =Peripheral; 4 =Rabattement.

Table 2: Description of variables

Name	Description
frequence	Categorical variable for the frequency: 1 =Low frequency, < 12 pairs of trips per day; 2 =Low-middle frequency, 13 - 20 pairs of trips per day; 3 =Middle-high frequency, 21-30 pairs of trips per day; 4 =High frequency, > 30 pairs of trips per day.
NbTrajets	Number of trips in the loop
Region OR CoderegionCAR	Region where the commune of the respondent is situated. These regions are dened by CarPostal as follows: 1 =Vaud; 2 =Valais; 3 =Delemont; 4 =Bern; 5 =Basel, Aargau, Olten; 6 =Zurich; 7 =Eastern Switzerland; 8 =Graubunden.
distance_km	Total distance performed for the loop.
Choice	Choice variable: 0 = public transports (train, bus, tram, etc.); 1 = private modes (car, motorbike, etc.); 2 = soft modes (bike, walk, etc.).
InVehicleTime	Time spent in (on-board) the transport modes only (discarding walking time and waiting time).
ReportedDuration	Time spent for the whole loop, as reported by the respondent. -1 represents missing values
CodeLangue	Language of the commune where the survey was conducted: 1 =French; 2 =German.
age	Age of the respondent (in years) -1 represents missing values.
X26_ActiviteDestination	The main activity at destination: 1 is work, 2 is professional trip, 3 is studying, 4 is shopping, 5 is activity at home, 6 is eating/drinking, 7 is personal business, 8 is driving someone, 9 is cultural activity or sport, 10 is going out (with friends, restaurant, cinema, theater) and 11 is other.
X281	Frequency of trips related to the household (drive someone, like kids, or shopping), 1 is never, 2 is several times a day, 3 is several times a week, 4 is occasionaly.

Table 3: Description of variables

Name	Description
X284	Most often mode used by the respondent to go to school as a kid (> 10), 1 is car (passenger), 2 is train, 3 is public transport, 4 is walking, 5 is biking, 6 is motorbike, 7 is other and 8 is multiple modes.
X286	Main place of residence as a kid (< 18), 1 is city center (large town), 2 is city center (small town), 3 is suburbs, 4 is suburban town, 5 is country side (village) and 6 is countryside (isolated).
X287	Frequency of the usage of car by the respondent's parents (or adults in charge) during childhood (< 18), 1 is never, 2 is occasionally, 3 is regularly and 4 is exclusively.
X288	Frequency of the usage of train by the respondent's parents (or adults in charge) during childhood (< 18), 1 is never, 2 is occasionally, 3 is regularly and 4 is exclusively.
X289	Frequency of the usage of tram, bus and other public transport (not train) by the respondent's parents (or adults in charge) during childhood (< 18), 1 is never, 2 is occasionally, 3 is regularly and 4 is exclusively.
X311	Number of persons in the household.
X312	Number of kids (< 15) in the household.
X313	Number of cars in the household.
X314	Number of motorbikes in the household.
X315	Number of bikes in the household.
X316	Number of bikes for kids in the household.
X317	Number of computers in the household.
X318	Number of TVs in the household.
X319	Internet connection, 1 is yes, 2 is no.
X320	Newspaper subscription, 1 is yes, 2 is no.
X321	Number of cell phones in the household (total).
X322	Number of smartphones in the household (total).
X323	House type, 1 is individual house (or terraced house), 2 is apartment (and other types of multi-family residential), 3 is independent room (subletting).
X324	Do you own the place where you are living? 1 is yes, 2 is no.

Table 4: Description of variables

Name	Description
X325	Number of rooms is your house.
X326	Number of years spent in the current house.
X327	Net monthly income of the household in CHF. 1 is less than 2500, 2 is from 2501 to 4000, 3 is from 4001 to 6000, 4 is from 6001 to 8000, 5 is from 8001 to 10'000 and 6 is more than 10'001.
X328	Gender of the respondent, 1 is man, 2 is woman.
X329	Year of birth of the respondent.
X337	Is equal to 1 if the respondent has a half-fare travelcard.
X339	Is equal to 1 if the respondent has a line-related season ticket.
X340	Is equal to 1 if the respondent has a GA (full Swiss season ticket).
X341	Is equal to 1 if the respondent has an area-related season ticket.
X342	Is equal to 1 if the respondent has a season ticket that was is not in the list.
X346	Represents the availability of a car for the respondent: 1 is always, 2 is sometime, 3 is never.

	nbr. cases	nbr. null	min	max	median	mean	std.dev
age	1906	0	-1	88	47	46.48	18.57
Choice	1906	536	0	2	1	0.78	0.54
CodageTypeCommune	1906	0	1	9	6	5.39	1.99
CodageUrbainRural	1906	0	1	2	2	1.51	0.5
CodeClassifLignes	1906	0	1	4	4	3.17	0.97
CodeLangue	1906	0	1	2	2	1.74	0.44
CoderegionCAR	1906	0	1	8	5	4.58	2.08
CoutAutoCHF	1906	5	0	67.65	2.98	5.76	8.34
distance.km	1906	1	0	519	18.75	40.38	62.6
DureeAuto	1906	28	0	494	26	40.68	47.61
DureeTP1	1906	7	0	745	85	107.88	86.52
frequence	1906	0	1	4	3	2.84	1.09
ID	1906	0	10350017	96040538	44690042	45878800	23846908
InVehicleTime	1906	66	-128	631	40.5	55.13	57.78
MarginalCost	1906	270	0	230	5.6	11.11	16.13
NbTrajets	1906	0	1	9	2	2.04	1.05
NbTransfertsTP1	1906	644	0	14	2	2.01	2.17
Region	1906	0	1	8	5	4.58	2.08
ReportedDuration	1906	3	-1	855	35	57.73	72.47
TrajetNo	1906	0	1	8	1	1.5	1.02
TripPurpose	1906	0	-1	3	2	1.94	1.18
WaitingTimeTP1	1906	693	0	392	5	13.13	22.07
WalkingTimeTP1	1906	17	0	213	33	39.63	28

Table 5: Descriptive statistics of variables (no data excluded)

Table 6: Descriptive statistics of variables affected by missing data (observations with -1 excluded)

	nbr. cases	nbr.null	min	max	median	mean	std.dev
age	1791	0	16	88	48	49.53	14.59
ReportedDuration	1835	3	0	855	37	60	72.92
TripPurpose	1783	0	1	3	3	2.14	0.92