Choosing carpooling or carsharing as a mode: Swiss stated choice experiments (I)

F. Ciari and K.W. Axhausen

INTRODUCTION

This study, commissioned by the Swiss national authority for roads ASTRA, assessed the carpooling potential in Switzerland and was conduced in collaboration with the consultant PTV Swiss. Formal carpooling is defined as two or more persons, not of the same household, sharing a trip, or a part of it, with the passengers contributing to the driver's expenses. Although several web-based carpooling platforms − where potential drivers and passengers can find potential trip-mates − are active in Switzerland, there is a knowledge gap about carpooling customers, actual and potential, regarding their preferences and motivations to participate in carpooling. A nationwide statistic of formal carpooling usage is not available, but from the Swiss national travel diary survey it is known that about 15% of all trips are made as passenger of a car. It is not specified if they carpool with a member of the household or not.

STATED CHOICE EXPERIMENTS

Two SC Experiments, respectively on Car-pooling and Car-sharing, per Person

Car-pooling: 8 Situations, 4 possible Alternatives (CP Driver, CP Passenger, Private Car, PT), 3 Alternatives per Person, Gasoline cost as basis

Car-sharing: 6 Situations, 3 possible Alternatives (CS, PC, PT), Global costs as basis

RECTRUITMENT AND RESPONSE

Time span (two Phases): Between 23. August and 25. October 2010 and 1. January and 18. April 2011

Eligibility condition: Driving license + Trip > 10km

2000 Addresses ➔ 1'683 Persons recruited ➔ 896 Respondents

Expected (estimated) Response rate: 45%

Actual Response Rate: 53%

Non-traders: Carpooling 27%, Carsharing 30%

Sample Statistics

		Respondents	Recruited	SNTD 2005 With driving licence
Gender	Male	55.0	56.4	50.0
	Female	45.0	43.6	50.0
Age	18-35	15.9	19.6	25.3
	35-50	39.9	38.4	32.4
	51-65	30.2	29.8	26.7
	> 65	14.0	12.2	15.9
Education	Compulsory Education or less	5.6	7.0	11.2
	Professional School	48.6	48.6	61.7
	College/University	44.5	44.5	27.1
Cars in the Household	0	4.0	4.5	9.1
	1	47.4	47.3	55.3
	2	39.7	38.5	28.9
	>2	8.9	9.7	6.7
Persons in the Household	1	10.6	10.8	27.7
	2	41.0	37.6	36.0
	3	15.4	17.0	11.7
	4	23.4	24.9	17.6
	> 4	9.6	9.7	7.0
PT Season Ticket	None	44.6	46.5	56.4
	Half Fare	40.9	39.8	30.3
	GA	10.8	9.9	5.8
	Other Discount Card	3.7	3.7	7.4
Income	< 2,000	3.6		2.7
	2,001−4,000	7.5		15.7
	4,001-6,000	22.1		27.6
	6,001−8,000	21.3		22.2
	8,001−10,000	16.1		14.3
	10,001−12,000	12.7		7.8
	12,001−14,000	5.3		4.1
	14,001−16,000	3.7		2.2
	> 16,000	7.6		3.3

ESTIMATION

The models were estimated using the software Biogeme, which estimates the parameters of various discrete choice models, including logit models, that were the modeling form chosen in this study. For each experiment two different formulations are proposed, one using a linear formulation of the model and one using a non linear formulation. The latter is obtained making use of continuous interactions between tastes and socio-demographic attributes, in this case trip distance and income, as alternative to the use of arbitrary segmentations into different income and distance classes. The interactions are assumed as follows:

$$f(y,x) = b_x (y/y^*)^{l(y,x)} x$$

where y is the observed value for a given socio-demographic variable, and y^* is a reference value, usually the mean value across a sample population.

RESULTS

Carpooling

		Linear Model		Elasticity Model	
	Observations: 5885	Adj. ρ^2: 0.221		Adj. ρ^2: 0.222	
Alternative	Utility parameters Name	Value	p-value	Value	p-value
All	Travel cost	-0.0569	0	-0.0502	0
	Elasticity Distance	-		-0.179	0
	Elasticity Income	-	-	*-0.162	0.27
	Walking time	-0.0438	0	-0.044	0
PT	Constant	-6.54	0	-6.7	0
	Travel time	-0.00774	0	-0.0111	0
	Transfers Time	-0.0799	0	-0.0674	0
	Transfers (n)	-0.104	0.03	-0.0961	0.04
	Season Ticket	0.987	0	0.975	0
	Log(Age)	1.36	0	1.35	0
	Inertia	2.07	0	2.1	0
Car	Constant	*-0.335	0.23	*-0.423	0.14
	Travel time	-0.03	0	-0.0343	0
	Parking cost	-0.065	0.04	-0.0654	0.04
	Male	0.652	0	0.654	0
	Car always available	0.401	0	0.41	0
	Inertia	0.767	0	0.746	0
CPD	Constant	*0.23	0.3	*0.217	0.35
	Travel time	-0.0348	0	-0.0394	0
	Parking cost	-0.154	0	-0.163	0
CPP	Travel time	-0.0379	0	-0.0446	0
CP	Previous Experience CP	*0.104	0.24	*0.102	0.25
	Female	-0.639	0	-0.638	0
	German Speaking	0.167	0.02	0.163	0.03
	Household Dimension	0.089	0	0.0881	0
	Work trip	*0.0553	0.42	*0.0691	0.32
	Positive opinion on CP	0.981	0	0.978	0
	Higher education	*0.101	0.13	*0.101	0.13
	Trip mate Acquaintance	0.268	0	0.275	0
	Trip mate Colleague	0.296	0	0.288	0
	No show risk	-0.0487	0	-0.048	0.01
	Ready to participate	0.371	0	0.376	0

- Female individuals are less attracted to carpooling, maybe for security concerns.

- Previous carpooling experience, positive orientation toward carpooling and readiness to carpool have a strong positive impact on the choice to carpool in the survey.

- The German speaking population of Switzerland has more open attitude towards innovative transport solutions.

- In general, persons with a higher education level (college and higher) and members of larger households are more likely to choose carpooling.

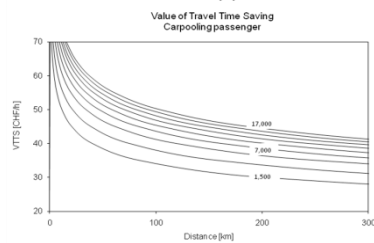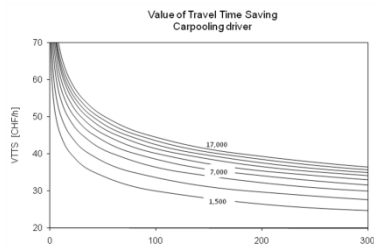**Contact:** ciari@ivt.baug.ethz.ch

Choosing carpooling or carsharing as a mode: Swiss stated choice experiments (II)

- The degree to which a potential trip mate is already known before to carpool is an important choice criteria.
- Carpooling is a slightly more likely choice for work trips.
- The inertia variables for "Car" and "Public Transport" modes are positive and significant.

Willingness to pay indicators

Indicator	Unit	Linear Value	Nonlinear Value
VTTS CPD	CHF/h	36.7	47.1
VTTS CPP	CHF/h	40.0	53.4
VTTS Car	CHF/h	31.7	41.0
VTTS PT	CHF/h	8.2	13.2
WTP PT Transfers (#)	CHF/Transfer	1.8	1.9
WTP PT Transfer Time	CHF/h	84.3	80.6
WTP Walking Time	CHF/h	46.2	52.6

Average Income = 8,300 CHF/Month
Average Trip Distance = 38.1 Km

Value of Travel Time Saving — Carpooling driver

Value of Travel Time Saving — Carpooling passenger

Carsharing

		Linear Model		Elasticity Model	
Observations: 4350	Adj. ρ^2:	0.275		0.279	
Alternative	Utility parameters Name	Value	p-value	Value	p-value
PT	Constant	1.35	*0.18	-1.58	0
	Travel cost	-0.0324	0	-0.0308	0
	Travel time	-0.0206	0	-0.0261	0
	Elasticity Distance	-	-	-0.304	0
	Elasticity Income	-	-	0.0922	*0.69
	Walking time	-0.0358	0	-0.0398	0
	Waiting time	-0.0364	0	-0.0312	0
	Connections	-0.137	0	-0.132	0
	Season Ticket	0.813	0	0.78	0
	Log(AGE)	0.499	0	0.552	0
	Log (INCOME)	-0.393	0	-	-
	German speaking	0.0836	*0.37	0.106	*0.26
	Inertia	1.09	0	1.03	0
Car	Constant	0.0235	*0.98	0.507	*0.08
	Travel cost	-0.0131	0	-0.0122	0
	Travel time	-0.0332	0	-0.0334	0
	Elasticity Distance	-	-	-0.183	0
	Elasticity Income	-	-	-0.497	0
	Walking time	-0.0194	0.03	-0.0215	0.02
	Parking cost	-0.0586	*0.06	-0.062	0.05
	Car always available	0.306	0	0.294	0.01
	Male	0.0629	*0.38	0.0938	*0.19
	Inertia	0.486	0	0.494	0
CS	Travel cost	-0.02	0	-0.0177	0
	Travel time	-0.0229	0	-0.0231	0
	Elasticity Distance	-	-	-0.22	0.04
	Elasticity Income	-	-	-0.247	0.04
	Walking time	-0.107	0	-0.106	0
	PT to reach station	-0.13	0	-0.128	0
	Parking cost	-0.0306	0	-0.0287	0
	Leisure Trip	0.0946	*0.3	0.104	*0.25
	Higher education	0.134	*0.15	0.156	*0.09
	Household Dimension	0.0394	*0.27	0.0415	*0.25
	Log (INCOME)	-0.0407	*0.66	-	-

- Leisure trips, the bulk of carsharing use in reality, are only marginally more likely to be carsharing trips in the responses.
- Experience or membership does not count in the choice; an attempt to introduce them in the model failed because they were insignificant.
- Income has a negative impact; more affluent individuals are more likely to drive their own car than to use carsharing.

Willingness to pay indicators

Indicator	Unit	Linear Value	Nonlinear Value
VTTS Car	CHF/h	151.59	163.70
VTTS CS	CHF/h	68.59	78.39
VTTS PT	CHF/h	38.16	50.76
WTP PT Transfer Time	CHF/h	67.42	60.59
WTP PT Transfers (#)	CHF /Transfer	4.22	4.28
WTP Walk Car	CHF /h	88.1	105.6
WTP Walk PT	CHF /h	66	77.4
WTP Walk CS	CHF /min	321	360
WTP PT Time to Station CS	CHF /min	390	433.7

Average Income = 8300 CHF/Month
Average Trip Distance = 38.1 Km

Value of Travel Time Saving — Carsharing
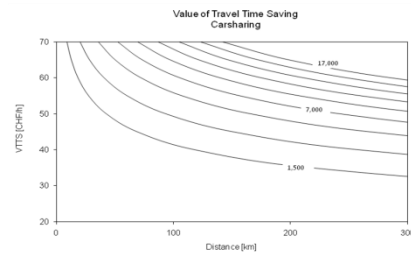
CONCLUSIONS

- The carpooling model has a lower fit than the carsharing one, despite a larger number of observations. This is probably because carpooling is less know than carsharing in Switzerland and the choice situation more difficult to imagine.
- Carpooling alternatives have a higher VTTS than car, suggesting that higher income persons prefer carpooling. This was not expected and this probably mean that the choice to carpool is not only of economic nature, but other motivations – environmental, social, etc. – also play an important role.
- Potential carpoolers prefer to be passenger rather than drivers. Carpool as passenger is a more attractive option, being comfortable and comparatively cheap.
- Overall, the results suggest the existence of a good unexploited potential for carpooling in Switzerland especially among relatively affluent and well educated people.
- The specific WTP indicator confirm the eminent importance of access convenience in the choice of carsharing.
- The choice of carsharing seems primarily economically driven.
- The next task the research team will tackle is the integration of the models in an agent-based micro-simulation tool where the results of this study will be used directly for the estimation of carpooling potential in Switzerland.