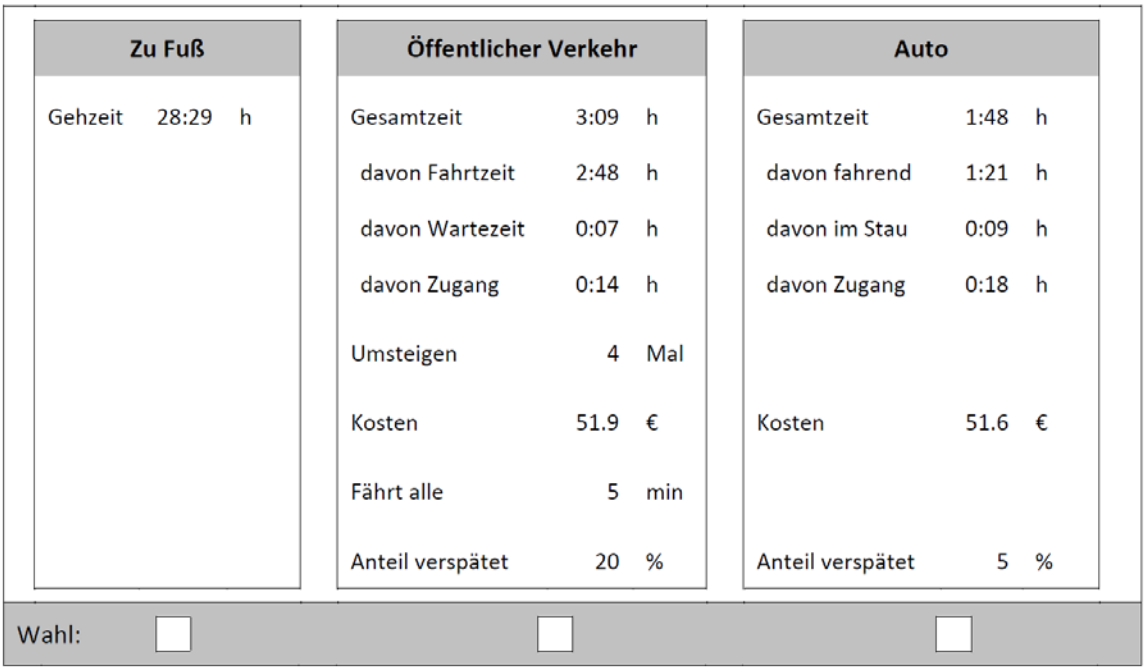
Situation 3



Zu Fuß			Öffentlicher Verkehr			Auto		
Gehzeit	28:29	h	Gesamtzeit	3:09	h	Gesamtzeit	1:48	h
			davon Fahrtzeit	2:48	h	davon fahrend	1:21	h
			davon Wartezeit	0:07	h	davon im Stau	0:09	h
			davon Zugang	0:14	h	davon Zugang	0:18	h
			Umsteigen	4	Mal			
			Kosten	51.9	€	Kosten	51.6	€
			Fährt alle	5	min			
			Anteil verspätet	20	%	Anteil verspätet	5	%
Wahl:	☐			☐			☐	

Determine VTTS for the German Federal Transport Infrastructure Planning – methods and experiences

Ehreke, Ilka, ETH Zurich
Weis, Claude, ETH Zurich

Conference paper STRC 2013

STRC | 13th Swiss Transport Research Conference
Monte Verità / Ascona, April 24-26,2013

Determine VTTS for the German Federal Transport Infrastructure Planning – methods and experiences

Ilka Ehreke
IVT, ETH Zurich
CH-8093 Zurich

Phone: +41 44 633 30 92
Fax: +41 44 633 10 57
email: ilka.ehreke@ivt.baug.ethz.ch

Claude Weis
IVT, ETH Zurich
CH-8093 Zurich

Phone:
Fax: +41 44 633 10 57
email: claude.weis@ ivt.baug.ethz.ch

April 2013

Abstract

In the course of compiling Germany's new Federal Transport Infrastructure Plan in 2015 the German Federal Ministry of Transport, Building and Urban Development (BMVBS) intents to carry out cost benefit analysis for several infrastructure projects. On this account a research group consisting of the IVT of the ETH Zurich and TNS Infratest redetermines the valuation for travel time saving (VTTS) and travel time reliability (VOR). The aim of the project is among other things to estimate a model for modal relocation in passenger and business traffic.

An individualized stated choice survey is the reasonable and established approach for an empirical answer to the core issues. On the basis of collected revealed preference data, a stated preference questionnaire is designed in a second step. Beside experiments concerning mode choice, route choice and route choice and departure time, also long term decision which will have an influence on future trips are taken into consideration. This involves residential choice as well as work choice decisions.

Likewise business traffic should be given particular attention in the future, emphasising on the effect of travel time on companies mode choice decisions besides logistic, fiscal, marketing and other influences. To complete scientific research and also to take practical experience into account, several qualitative interviews respective an employee's mode choice are conducted with decision makers in different companies.

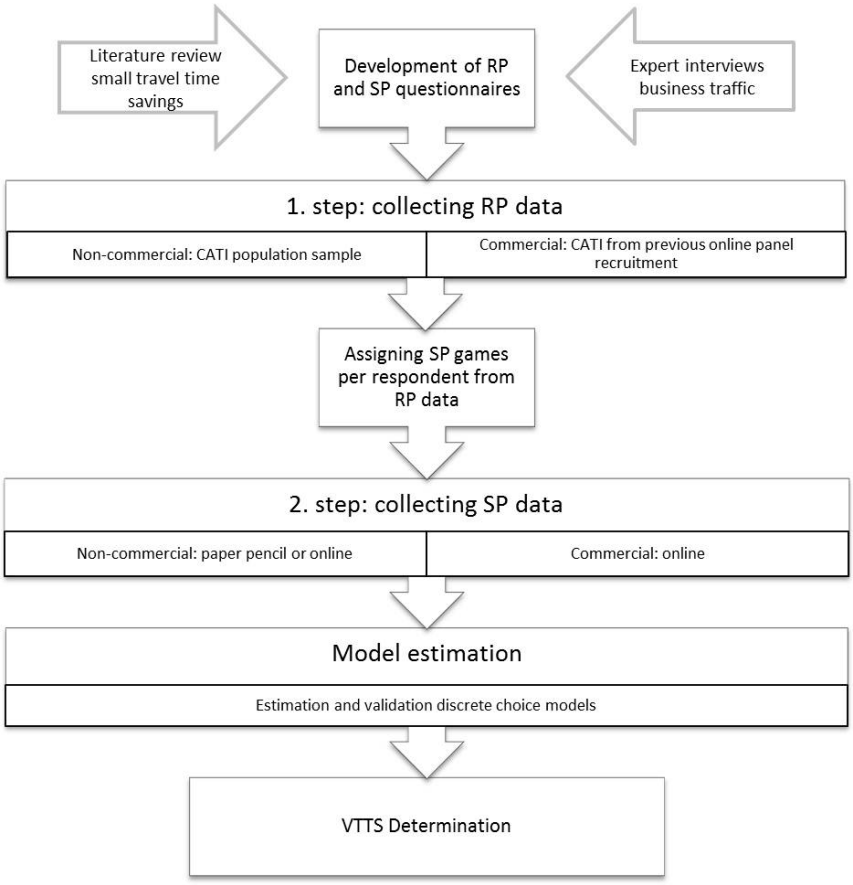
Keywords

Value of travel times - value of reliability - discrete choice modelling - German VTTS - German Federal Transport Infrastructure Plan - business traffic

1. Introduction

In the course of compiling Germany's new Federal Transport Infrastructure Plan in 2015, the Federal Ministry of Transport, Building and Urban Development (BMVBS) intends to carry out cost-benefit analyses to evaluate the effect of transport policies and investments for several infrastructure projects. Travel time savings often have the largest share in gains on the utility side of CBAs (Mackie et al. 2001). On this account a research group consisting of the IVT of the ETH Zurich and TNS Infratest redetermines the valuation for travel time saving (VTTS) and travel time reliability (VOR) for the BMVBS. The aim of the project is, among other things, to estimate a model for modal relocation in passenger and business travel. An individualized stated choice survey is the reasonable and established approach for an empirical answer to the core issues (e.g. Small 2012). On the basis of collected revealed preference (RP) data, a stated preference (SP) questionnaire is designed in a second step.

Figure 1 German VTTS study



Beside experiments concerning mode choice, route choice and route choice and departure time, long term decisions which will have an influence on future trips are also taken into consideration. This involves residential choice as well as work choice decisions. A secondary literature review focuses on the state of the art concerning small travel time savings (less than five minutes) and whether those need special treatment for VTTS estimation. Likewise business travel should be given particular attention in the future, emphasizing on the effect of travel time on companies mode choice decisions besides logistic, fiscal, marketing and other influences. Figure 1 shows the different steps of the study.

2. Study design

As mentioned above, for later estimations it was of importance to ascertain if small travel time savings (in general less than 5 minutes) require special treatment or can be integrated equally in the model estimations. Therefore a secondary literature review on the state of the art of specific research was conducted. The inquiries for non-commercial and commercial traffic were carried out as follows.

2.1 Non-commercial traffic

For non- commercial traffic first a representative sample of respondents over the age of eighteen were recruited for a CATI interview (telephone and cell phone) and randomly assigned a focus trip and a long term decision experiment. The share of telephone and cell phone calls is 60:40 following recent market research guidelines. Table 1 gives an overview of the different attributes used in the SP sets.

Table 1 Overview attributes mode and route choice and route choice and departure time

attributes	mode choice						route choice		route choice and departure time	
	walk	bike	mpt	put	bus	plane	mpt	put	mpt	put
time	x	x	x	x	x	x	x	x	x	x
access time			x	x	x	x	x	x	x	x
congestion/waiting time			x	x	x	x			x	
congestion							x			x
waiting time								x		x
cost			x	x	x	x	x	x	x	x
parking costs							x			
change				x	x	x		x		x
frequency				x	x	x				
share delayed trips			x	x	x	x	x	x		
travel time distribution									x	x

The origin and destination and the exact route of the trip were determined, as well as detailed information on residential or work choice decisions. Additionally, details on one long distance trip, the everyday destinations and an average trip were compiled. Second, the stated preference questionnaires were constructed based on the focus trips from the RP experiments. Respondents received at least two (from three) SP game sets of either mode choice, route choice or route and departure time choice. The SP questionnaires included attitudinal questions for later model estimations as well.

They were either sent by post to the respondents or could be completed online. Table 2 shows the 18 different types of questionnaires which were assigned to the respondents randomly. Three different versions of presenting the reliability sets were tested and are represented by the numbers one to three in table 2.

Table 2 Types non-commercial questionnaires

trip	reported mode	mode choice	route choice	reliability	long term
average	walk	walk/put/mpt	--	--	workplace
	walk	walk/put/mpt	--	--	residential
	bike	bike/put/mpt	--	--	residential
	bike	bike/put/mpt	--	--	workplace
	put	bike/put/mpt	--	put 1	workplace
	put	--	put	put 2	residential
	mpt	walk/put/mpt	--	mpt 1	residential
	mpt	--	mpt	mpt 2	workplace
journey	put	bus/put/mpt	--	put 3	workplace
	put	--	put	put 1	residential
	mpt	bus/put/mpt	--	mpt 3	residential
	mpt	--	mpt	mpt 1	workplace
	put	put/mpt/plane	--	put 2	workplace
	put	--	put	put 3	residential
	mpt	put/mpt/plane	--	mpt 2	residential
	mpt	--	mpt	mpt 3	workplace
	plane	put/mpt/plane	--	plane 1	workplace
	plane	put/mpt/plane	--	plane 2	residential

2.2 Commercial traffic

Participants in the business travel survey were preselected online and afterwards interviewed in a CATI as well. Each of the respondents reported their last three business trips from which the most recent one became the focus trip. Based on that trip the SP game set was conducted as described for the non-commercial survey. Table 3 shows the different types of questionnaires for the commercial SP survey. The SP games for business trips were completed online.

Table 3 Types commercial questionnaires

trip	reported mode	mode choice	route choice	reliability
short	walk	walk/put/mpt	--	--
	bike	bike/put/mpt	--	--
	put	bike/put/mpt	--	put 1
	put	--	put	put 2
	mpt	walk/put/mpt	--	mpt 1
	mpt	--	mpt	mpt 2
medium	put	bus/put/mpt	--	put 3
	put	--	put	put 1
	mpt	bus/put/mpt	--	mpt 3
	mpt	--	mpt	mpt 1
long	put	put/mpt/plane	--	put 2
	put	--	put	put 3
	mpt	put/mpt/plane	--	mpt 2
	mpt	--	mpt	mpt 3
	plane	put/mpt/plane	--	plane 1
	plane	--	--	plane 2

To validate if employees are the right respondents to address, expert interviews with decision makers were conducted to find out how mode and route choice decisions are made in companies. In the business context, mode and route choice is likewise a strategic solution of the company besides fiscal, image and logistic consideration. Occasionally the employee of a company has only little influence on the mode or route he or she chooses for business trips but rather has to follow company guidelines.

Therefore it seems necessary to study the background of those decisions to find out the right addressee for the business traffic experiments. To complete scientific research, and also to take practical experience into account, several qualitative interviews focusing on employees'

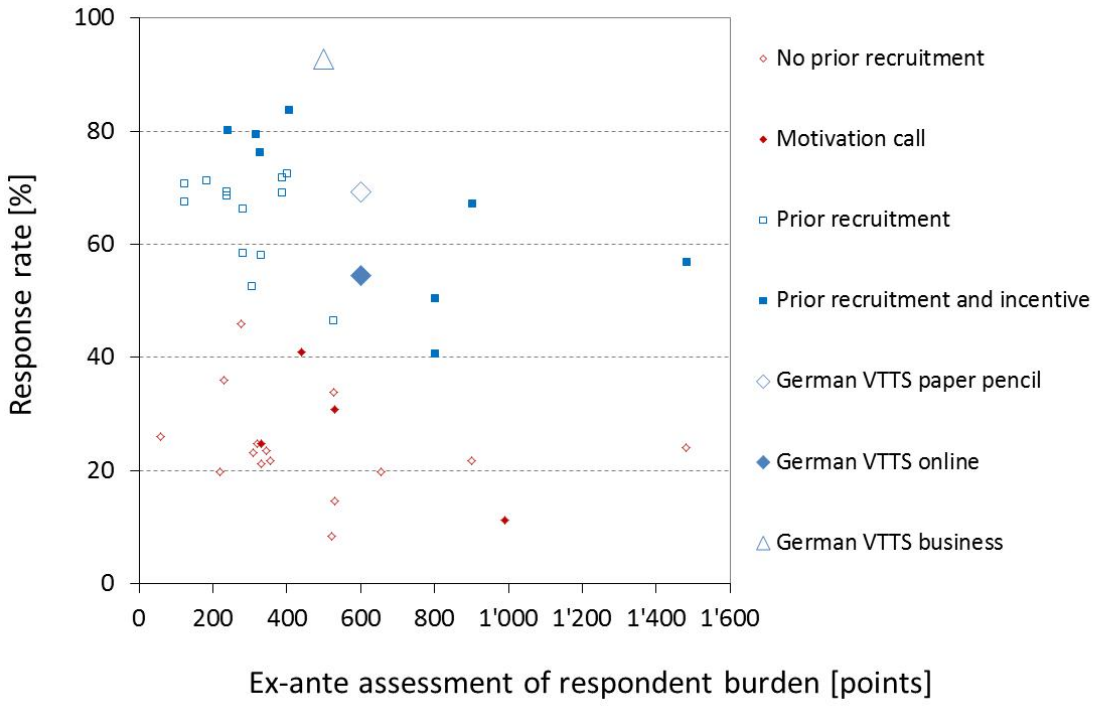
mode and route choice are conducted with decision makers in different companies. As the willingness to attend an expert interview is usually low in the business environment 750 addresses were bought from an address data base. These were selected and weighted by industry, enterprise size and geographic location within Germany to achieve a previous homogeneous distribution of the companies.

In a first step the chairmen or responsible managers of the companies were contacted by post including a recommendatory letter of the German Federal Ministry of Transport, Building and Urban Development. In a second step the same persons were contacted with VOIP software. The interviews with the attendees were conducted and recorded likewise.

3. Response rate

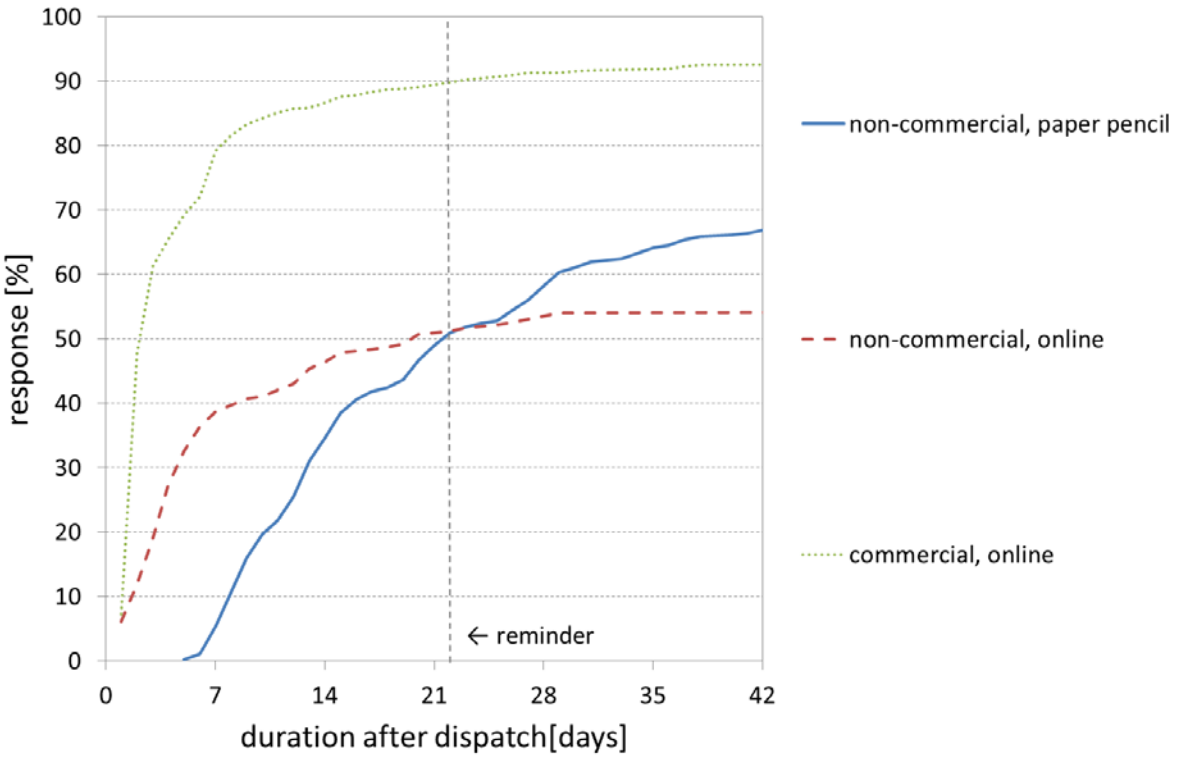
The two step survey was carried out in seven waves from July to September 2012 (after a pretest in May). Including the pretest data 2'420 non-commercial and 839 commercial respondents completed the full questionnaire (RP and SP data). Hence the sample contains almost 65,000 observations. Figure 2 shows the predicted response burden and response rates following Axhausen and Weis (2010).

Figure 2 Response rate German VTTS



It can be asserted that all three alternatives are settled in the expected range. The respondents for the commercial online questionnaire were preselected via an online panel which is why the response rate for the commercial data sample is the highest. Also these respondents completed the games quickly but as well the reminder was less effective than for the non-commercial respondents. The non-commercial paper pencil respondents took more time to complete their set of games due to delivery reasons. But in the end they reached a higher response rate than the completed non-commercial online questionnaires. The reminder showed the biggest effect on the paper pencil respondents (see figure 3).

Figure 3 Response speed



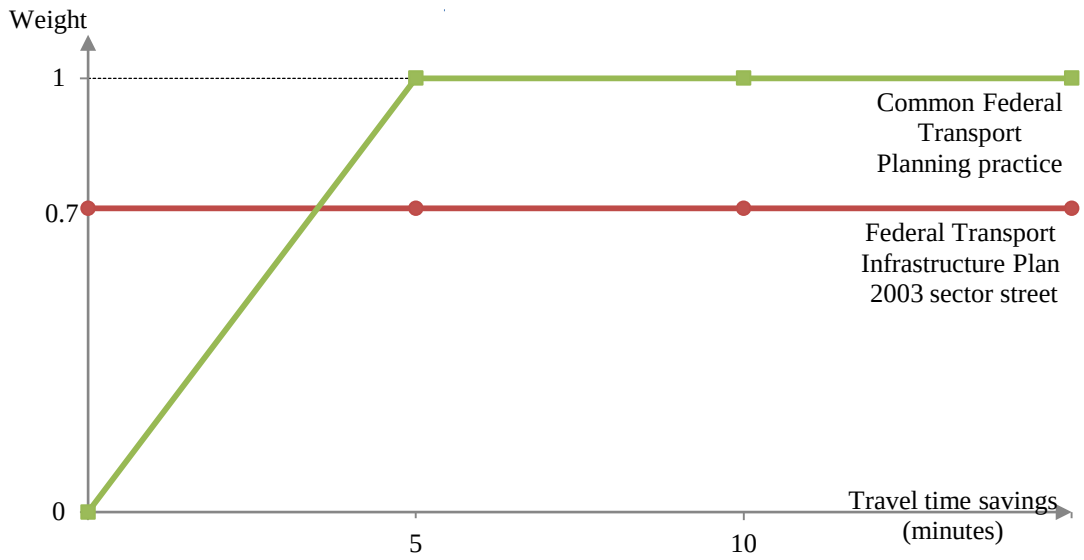
4. First results

4.1 Small travel time savings

Applying CBAs to evaluate German infrastructure projects travel time savings often represent the largest share of utility gains (Willeke et al. 1979). The share is clearly decreasing if small travel time savings with less than 2, 5 or 10 minutes are not taken into account (Ecoplan 2005). Welch and William (1997) show for example that in some British VTTS studies the amount of travel time savings lies well beneath 2 minutes. Different approaches suggest different treatments of small time savings for formal CBAs as a uniform value for all savings (in some cases with separate reporting) or a smaller or zero unit value (Daly 2011). Thus small travel time savings of a large amount of people can also function as a strategic factor in the decision making process accomplishing or refusing an infrastructure project.

In preparation of the German VOT study it was therefor of importance to determine the state of the art of small travel time savings in international research context respectively value of time studies. The common German planning practice devaluates non-commercial time savings less than 5 minutes continuously (BVU 2009 see figure 4).

Figure 4 Weighting of travel time savings in Germany



Source: BVU et al. (2009)

The literature review shows that several problems occur defining and distinguishing small travel time savings. First for example there is no consistency of the definition of "small" and "noticeable". Based on the study it can vary between 2 and 20 minutes and therefor can have a relevant influence on the results of a study (Austroads 2011). Furthermore, time losses are often valuated stronger than gains. Also it cannot be explicitly determined how accurate small savings are estimated and if these are real effects or just model artefacts. Nevertheless most of the North American and Western European countries – except Canada and Germany – treat small travel time savings equally (Daly 2011).

Taking the state of the art of international research into account, the recommendation to the BMVBS is to treat small value of travel time savings equally (Ehreke 2012). However the collected SP data would be sufficient if an additional analysis appears desirable.

4.2 Expert interviews

A total of 24 decision makers participated in the qualitative interviews (see table 2). It turned out that employees clearly have the freedom to choose their preferred travel routes, as 22 experts agreed to that question.

Table 4 Summary expert interviews

	No of Companies	
1. Total first contact (letter)	750	
Unknown		20
No answer		262
2. Contact (call)		221
Total denial (letter + call)	220	
Willingness to attend	27	
From 1. contact (1 person not suitable)		8
From 2. contact (2 persons not suitable)		19
Total not suitable		3
Net interviews	24	

Mode choice decisions are made jointly by employees and decision makers of a company. However, the employee's constraints are often more of a higher general order than a direct advice by the decision makers.

Further findings are that the car is most frequent mode choice due to time and flexibility reasons as most mobility concepts are optimized towards cost and time. Most of the

employees travel alone or in small groups and about one fifth of the employees of a company need to go on business trips. Nevertheless it can be stated that interviewing individual employees for mode and route choice SP experiments is a plausible and valid approach for commercial traffic.

4.3 Preliminary descriptive evaluation RP data

Figure 5 shows the trip distance distribution by the single purposes. The respondents cover the shortest distance for their shopping trips as the curve is very steep and 90 per cent of the trips are not longer than 10km. The biggest share of trips to work or education are not longer than 50km. Afterwards the curve flattens which could be due to commuters who travel long distance to their workplace. The distance distribution of leisure trips starts steep which indicates that respondents fulfil about 20 per cent of their leisure activities within a radius of 20km. But they are also willing to cover long distances to reach their destination e.g. to go on vacation. The figure clearly shows, that business trips have usually the longest distances from origin to destination which.

Figure 5 Trip distance by purpose

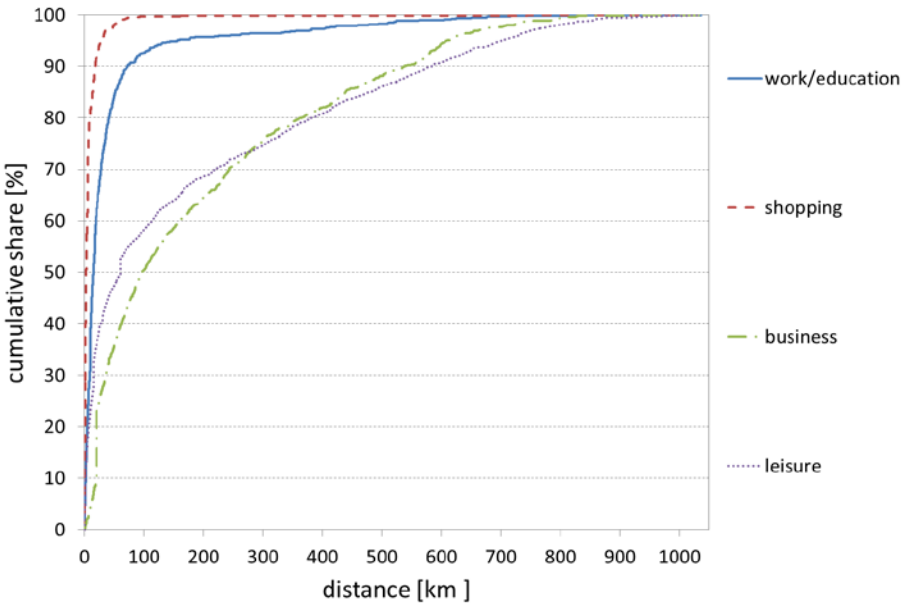


Table 5 gives an overview of the characteristic socio demographic variables of the non-commercial RP sample. The data is adjusted to the desired demographic structures (for example age, gender, employment). The so called mobility tools such as driver's license or car availability are adjusted according to the MiD 2008 (infas and DLR 2010).

Table 5 Overview non-commercial socio-demographic variables (person weighted)

Attribute	Per cent	Cumulative per cent
Gender		
Male	53.56	53.56
Female	46.44	100.00
Age		
<= 29	12.43	12.43
30 - 39	18.23	30.66
40 - 49	25.71	56.37
50 - 59	24.16	80.53
60 - 69	12.57	93.11
70 - 79	6.08	99.18
80+	0.82	100.00
Household size		
1	24.12	24.12
2	37.42	61.53
3	18.51	80.04
4	14.37	94.41
5+	5.51	99.93
Don't say	0.07	100.00
Employment		
Full time	59.22	59.22
Part time	15.31	74.53
Apprentice	0.77	75.30
Unemployed	2.41	77.71
Retired	15.14	92.85
Pupil	0.72	93.57
Student	2.87	96.45
Housewife	2.29	98.74
Else	1.26	100.00
Income		
0 - 1000	2.50	2.50
1000 - 1500	7.38	9.89
1500 - 2000	8.93	18.81
2000 - 2500	14.77	33.58
2500 - 3000	16.31	49.89
3000 - 3500	23.35	73.24
3500 - 4000	9.02	82.26
4000 - 4500	7.95	90.21
4500 - 5000	5.61	95.82
5000+	4.18	100.00
Drivers licence		
No	5.12	5.12
Yes	94.88	100.00
Bahncard		
None	85.63	85.63
25	8.20	93.83
50	5.61	99.44
100	0.33	99.77
Don't know/Don’t say	0.24	100.00
Car availability		
No Car	1.26	1.26
Always	80.46	81.72
Sometimes	8.53	90.25
Never	9.61	99.86
Don't know/don’t say	0.14	100.00

5. Outlook model estimations

First general mode and route choice MNL models have been estimated including linear terms for all attributes, non-linear (logarithmic) terms for travel time and cost and interaction terms between income, cost and time and travel time, number of transfers and headway. The estimated parameters showed the expected signs and plausible sizes and ratios. The goodness of fit test achieved good results as well.

The first MNL runs showed plausible results with a convincing goodness of fit. As a next step further discrete choice models will be estimated including socio-economic data or mode choice preferences to spot possible heterogeneities in the valuation of time. Mixed logit models will provide information about randomly distributed preferences and valuations. A general model for the whole sample containing all RP and SP data promises even more robust good-ness of fit. Finally estimating latent class models including attitudinal valuations is conceivable.

6. References

Austroads (2011) Small Travel Time Savings: Treatment in Project Evaluations, Austroads Publications Online, Sydney, https://www.onlinepublications.austroads.com.au/items/AP-R392-11, Februar 2012.

Axhausen, K.W., Weis, C. (2010) Predicting response rate: A natural experiment, Survey Practice, 3 (2), http://surveypractice.org/2010/04.

Bierlaire, M. (2003). BIOGEME: A free package for the estimation of discrete choice models , *Proceedings of the 3rd Swiss Transportation Research Conference*, Ascona, Switzerland.

Bim, K, H. Bolik und P. Rieken (2005) Die gesamtwirtschaftliche Bewertungsmethodik Bundesverkehrswegeplan2003, Schlussbericht zum FE-Vorhaben 96.0790/2003 im Auftrag des BMVBW, Berlin.

Daly, A., Tsang, F., Rohr C. (2011) The value of small time savings for non-business travel, European Transport Conference, Glasgow.

Ecoplan and Metron (2005) Kosten-Nutzen-Analysen im Strassenverkehr, Kommentar zur VSS-Grundnorm, Gelbe Schriftenreihe, Bern.

Ehreke, I. (2012) Zum Umgang mit kleinen Zeitgewinnen im nichtgewerblichen Personenverkehr, report to the BMVBS.

infas and DLR (2010) Mobilität in Deutschland 2008.

Li, Z., D.A. Hensher und J.M. Rose (2010) Willingness to pay for travel time reliability in passenger transport: A review and some new empirical evidence, Transportation Research E, 46 (3) 384-403.

Mackie, P.J., Jara-Díaz, S., Fowkes, A.S. (2001) The value of travel time savings in evaluation, *Transportation Research E,* **37**, 91-106.

Small, K.A. (2012) Valuation of travel time, Economics of Transportation, **1**, 2-14.

Welch, M., Williams H. (1997) The Sensitivity of transport investment benefits to the evaluation of small travel time savings, *Journal of Transport Economics and Policy*, **31**, 231-254.

Willeke, R, Ollick, F., Zebisch, K.D. (1979) Nutzen-Kosten-Analysen für Investitionen im öffentlichen Personennahverkehr: Methoden und Ergebnisse der Standardisierten Bewertung, Verkehrs-Verlag J. Fischer, Düsseldorf.