

## Preferred citation style for this presentation

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# The German value of time & value of reliability study

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# German VOT & VOR study

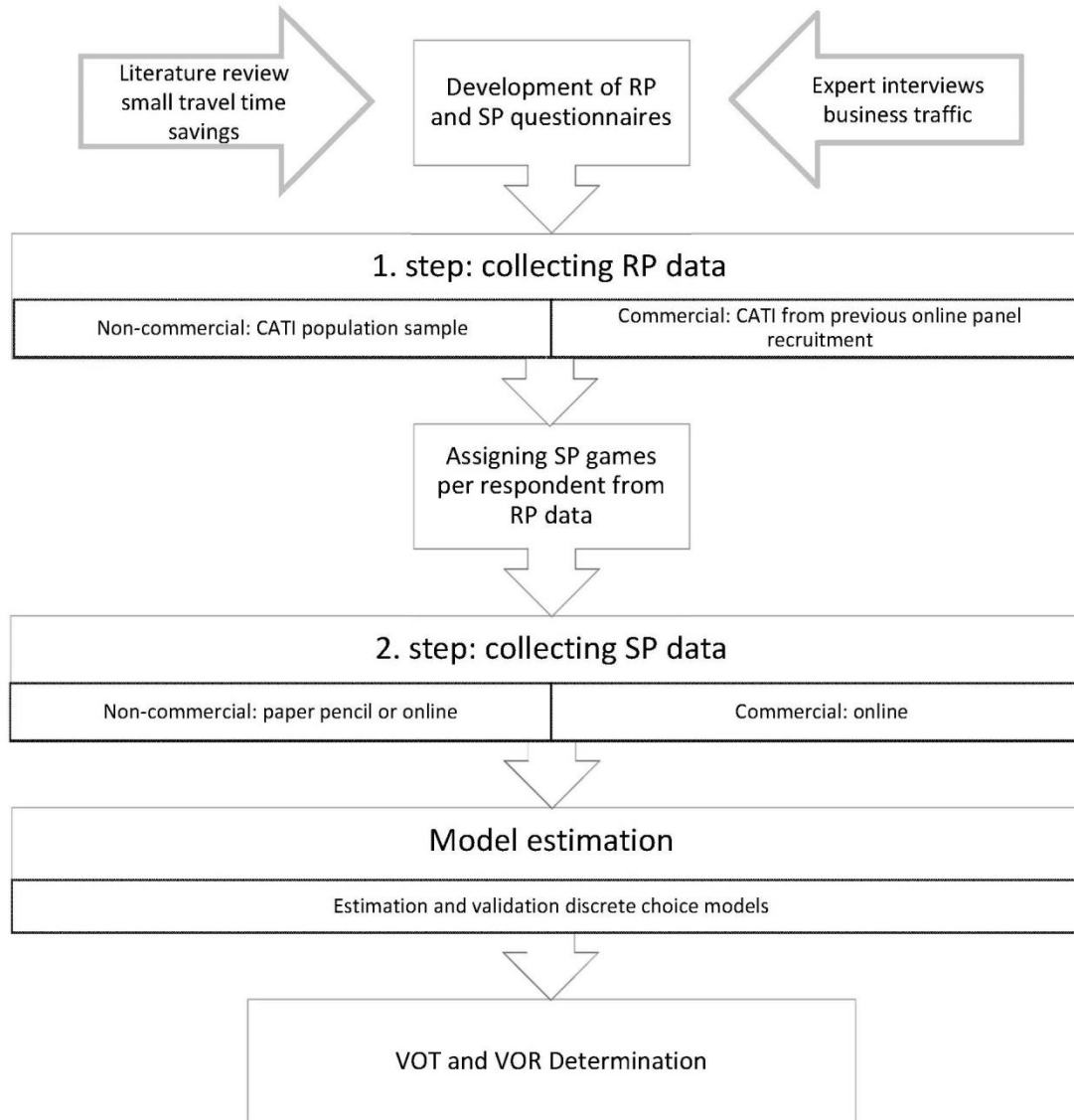
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## VOT and VOR for Federal Transport Investment Plan 2015

- update the overall methodology of the CBA
- 2 step RP/SC survey
- special focus on commercial trips
  - check the modelling approach
  - compare to other approaches
- additional: how to deal with small travel time saving?

# Study design - process

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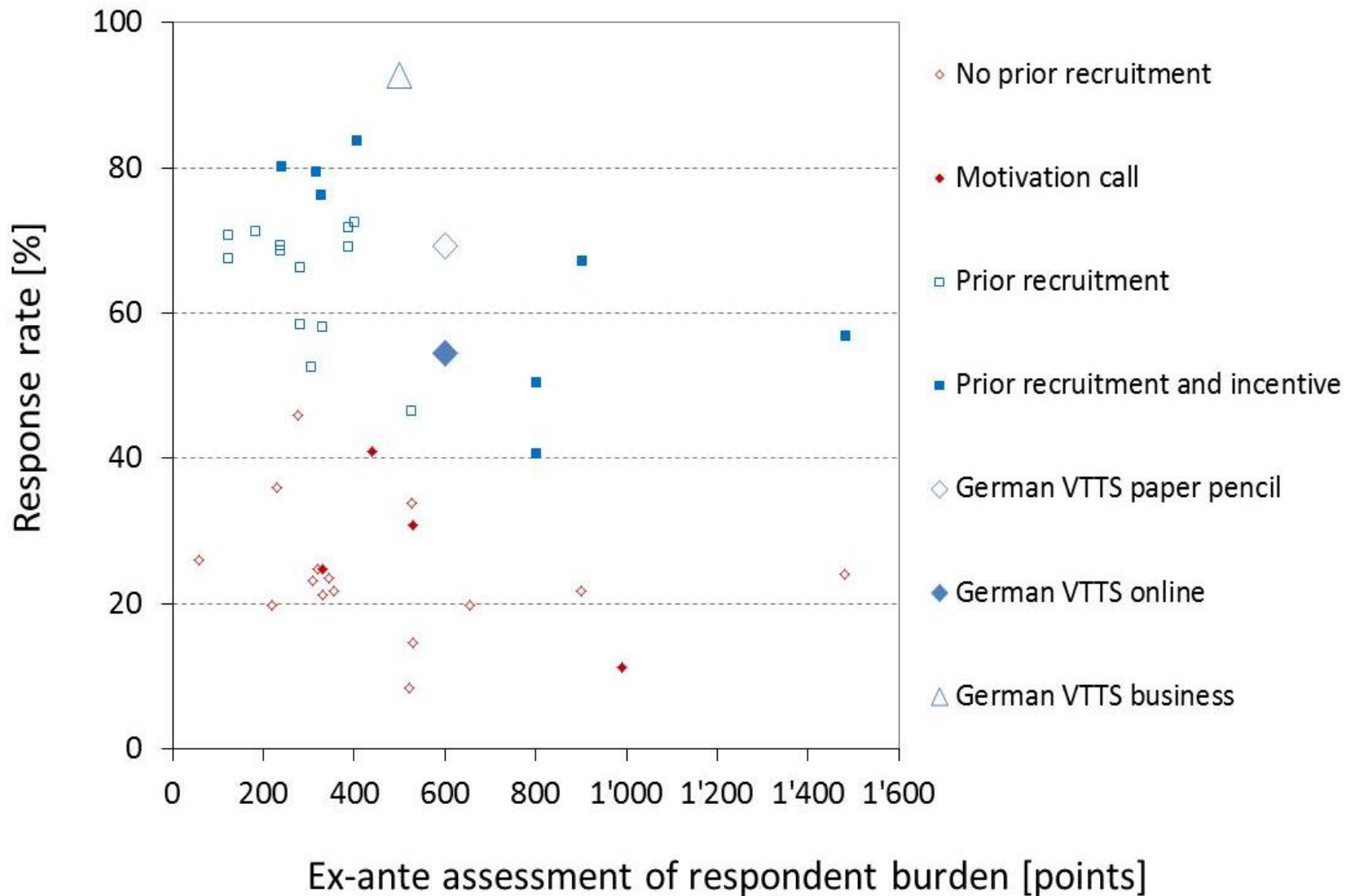


# Response behaviour main study

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	non-comm.	commercial
contacts	9,491	1,112
completed CATI	3,151	848
Indicated willingness to participate written SC experiment	2,965	-
Indicated willingness to participate online SC experiments	186	848
Completed written SC experiments	2,187	-
Completed online SC experiments	98	786

# Response rate



## Example SC Experiments: trips 12-500km

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RP main mode	SC mode choice	SC route choice	SC reliability	Long term	no
PUT	PUT/ MPT/Plane	-	PUT type 2	work	13
PUT	-	PUT	PUT type 3	resident.	14
MPT	PUT/ MPT/Plane	-	MPT type 2	resident.	15
MPT	-	MPT	MPT type 3	work	16

# Example SC experiment: Mode choice

<b>Fahrrad</b>	<b>Öffentlicher Verkehr</b>	<b>Auto</b>
Fahrtzeit 0:38 h	Gesamtzeit 0:27 h davon Fahrtzeit 0:15 h davon Wartezeit 0:06 h davon Fußweg 0:06 h  Umsteigen 3 Mal  Kosten 2,10 € (17€/Monat bei 4 Fahrten)  Fährt alle 10 min  Anteil verspätet 20 %	Gesamtzeit 0:19 h davon fahrend 0:13 h davon im Stau 0:03 h davon Fußweg 0:03 h  Kosten 1,70 € (14€/Monat bei 4 Fahrten)  Anteil verspätet 5 %

Wahl:



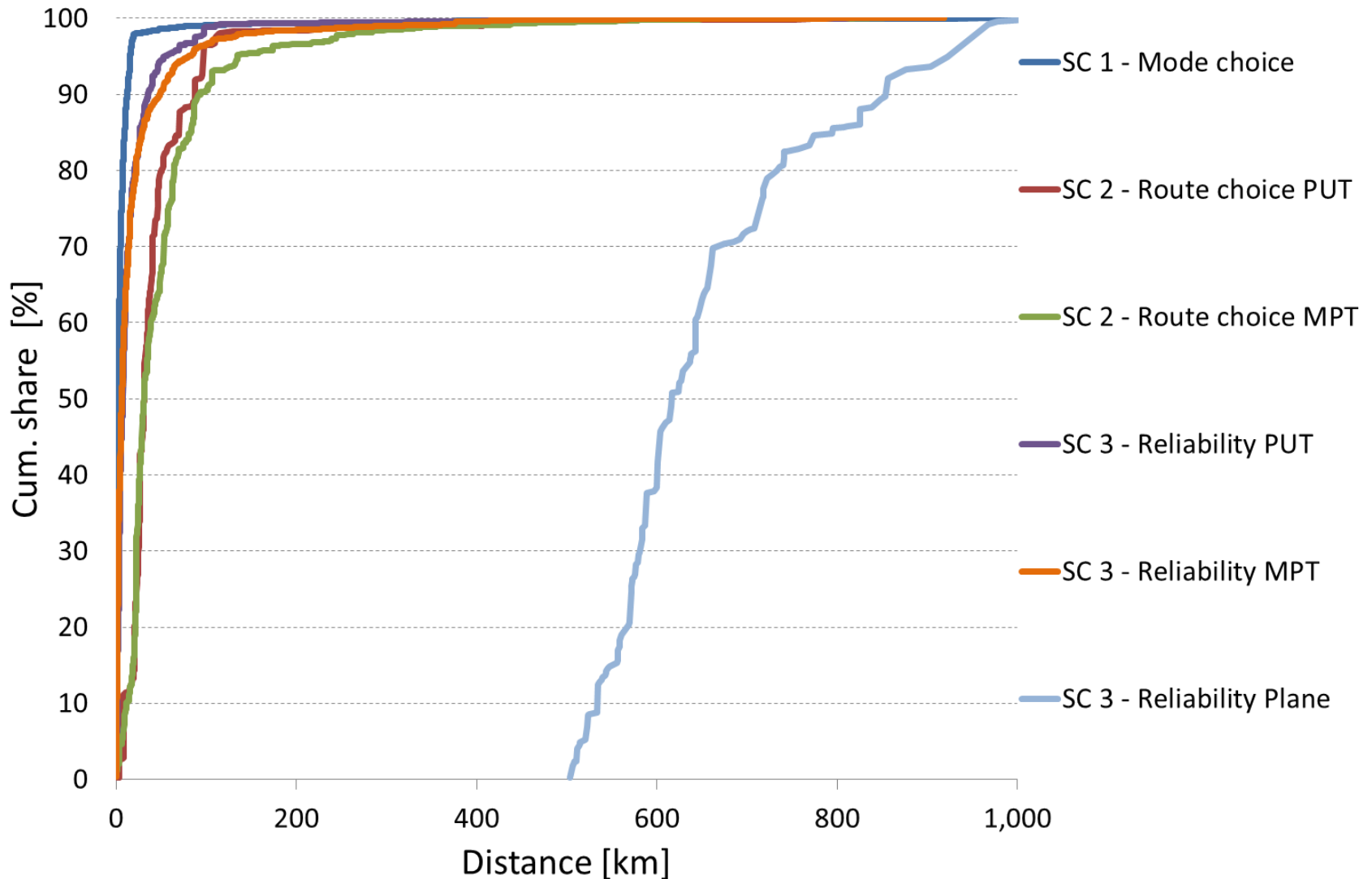
# Example SC experiment: Reliability & route choice

Route 1		
Abfahrtszeit	7:09	Uhr
Erwartete Gesamtzeit	1:06	h
davon fahrend	0:58	h
davon im Stau	0:03	h
davon Fußweg	0:05	h
Erwartete Ankunftszeit	8:15	Uhr
(in 85 % der Fälle)		
in 5 % der Fälle	8:10	Uhr
in 10 % der Fälle	8:25	Uhr
Kosten	5,70	€

Route 2		
Abfahrtszeit	6:19	Uhr
Erwartete Gesamtzeit	1:26	h
davon fahrend	0:58	h
davon im Stau	0:13	h
davon Fußweg	0:15	h
Erwartete Ankunftszeit	7:45	Uhr
(in 40 % der Fälle)		
in 20 % der Fälle	7:40	Uhr
in 40 % der Fälle	7:55	Uhr
Kosten	6,90	€

Wahl:

# Distance distribution SC types



# Model estimation: utility function

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$x_{i,j}$  = travel time, costs:

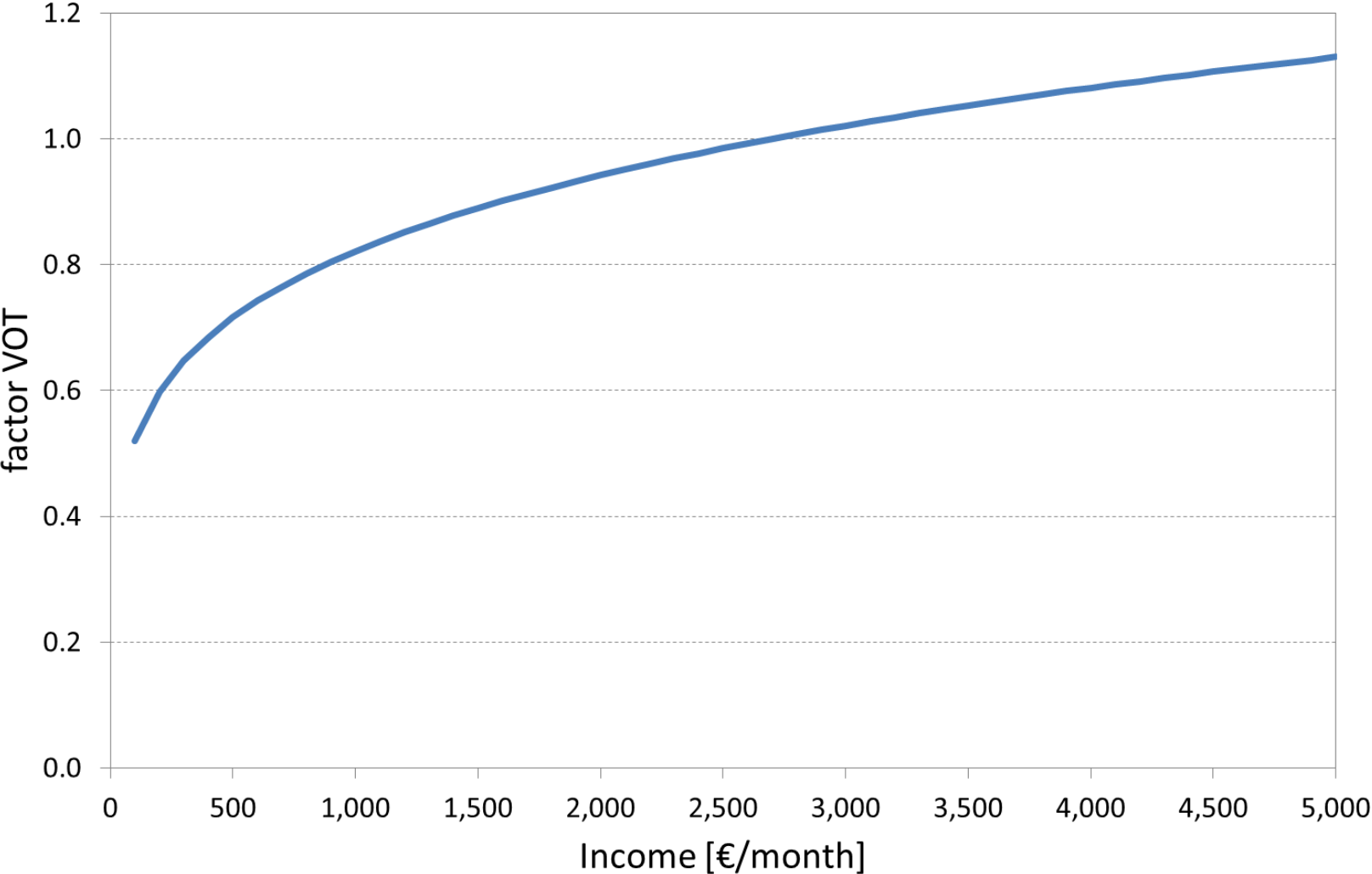
$$U_i = \sum \dots \left( \beta_{i,j} \cdot x_{i,j} + \alpha_{i,j} \cdot \ln(x_{i,j} + \gamma_{i,j}) \right) \cdot \left( \frac{\text{income}}{\mu(\text{income})} \right)^{\lambda_{i,j,\text{income}}}$$

$x_{i,j}$  = access time, waiting time, change, frequency, delay

$$U_i = \sum \dots \left( \beta_{i,j} \cdot x_{i,j} \right) \cdot \left( \frac{\text{travel time}}{\mu(\text{travel time})} \right)^{\lambda_{i,j,\text{traveltime}}}$$

# VOT and income

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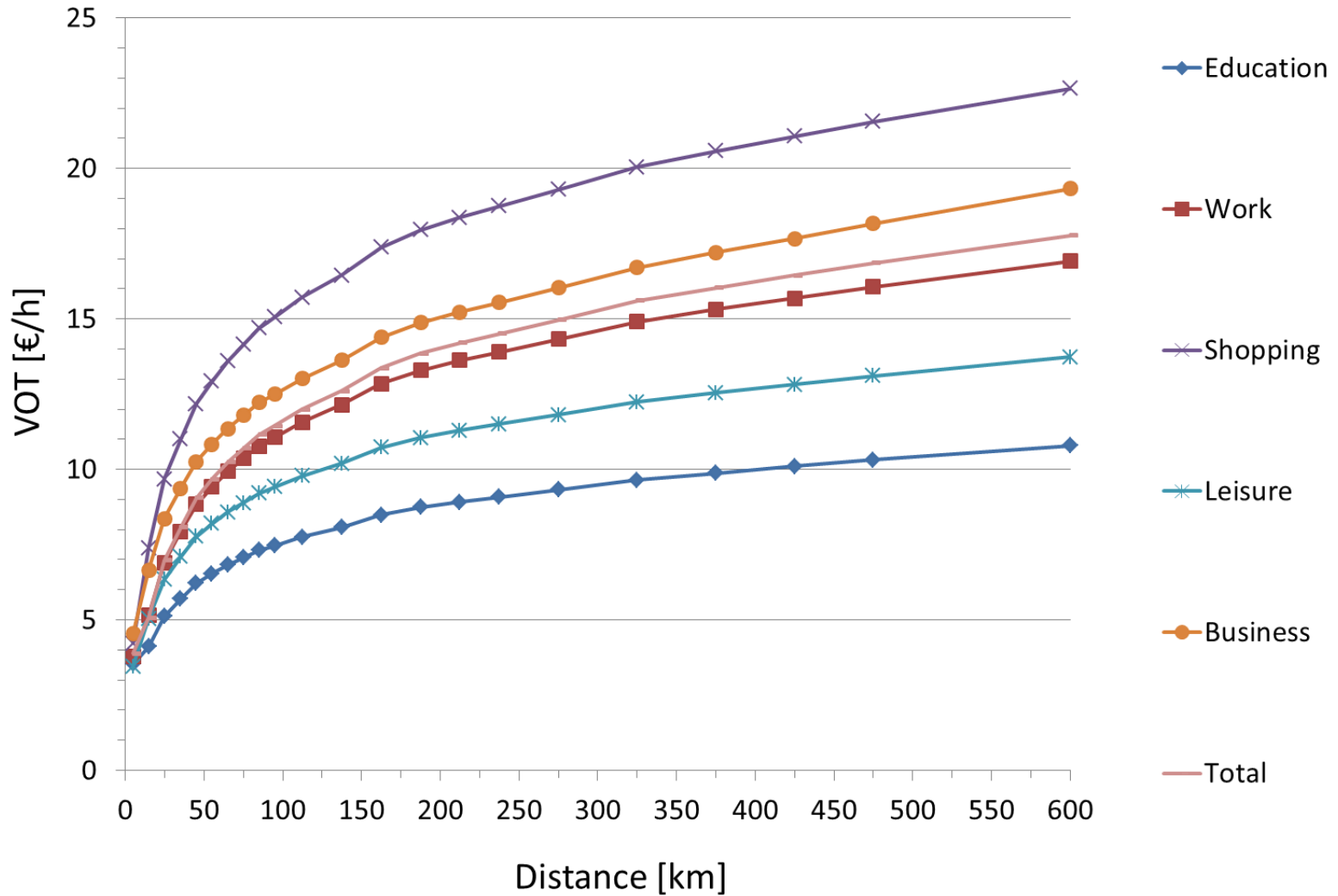


## Value of time €/h (weighted means)

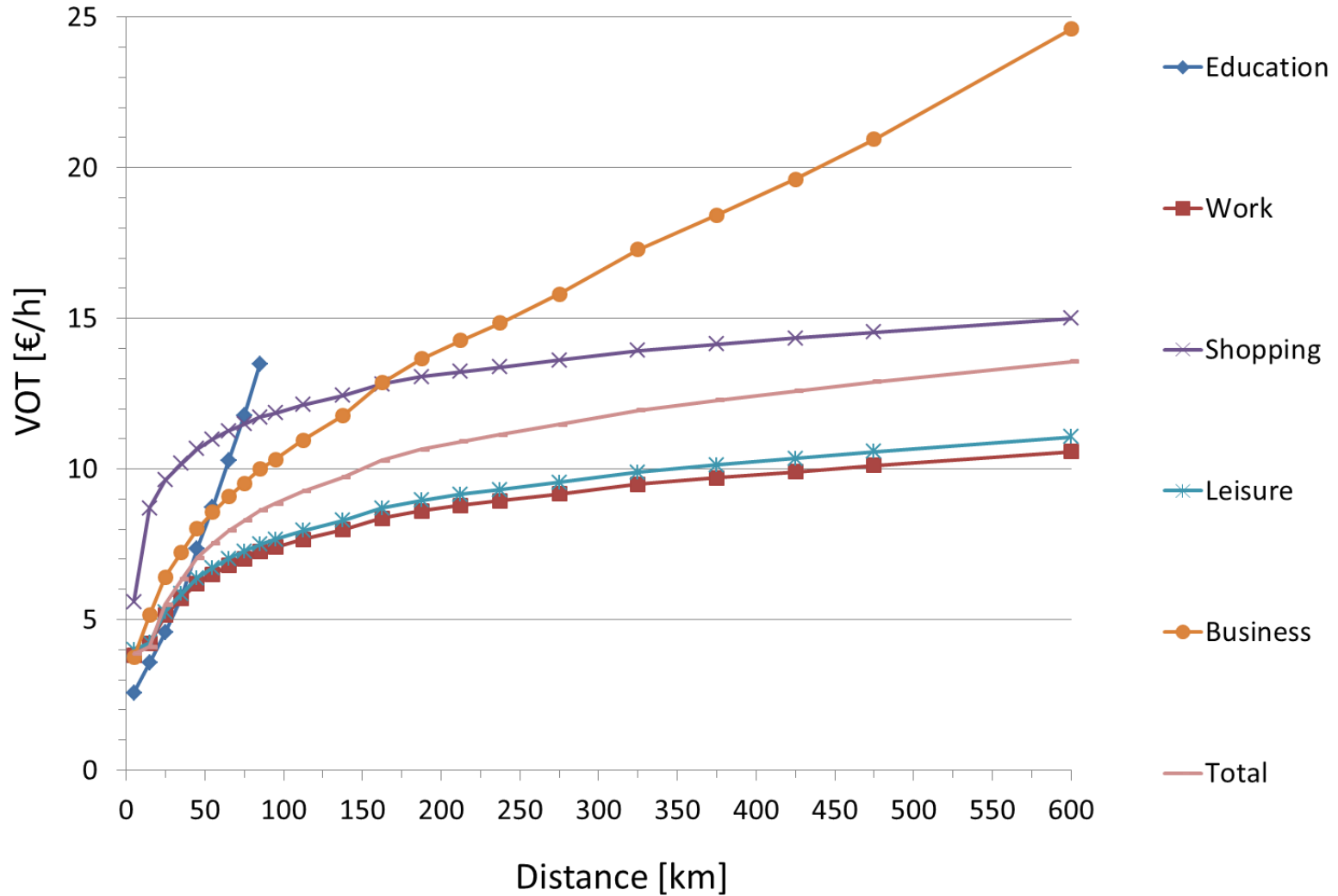
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Trip purpose	MPT	PUT	Plane	Total
Education	3.90	4.39	--	4.26
Commute	4.87	4.47	--	4.80
Shooping	4.29	5.11	--	4.62
Leisure	4.03	4.35	25.45	4.35
Business	8.38	7.01	38.76	8.50
Total	4.66	4.83	33.67	4.83

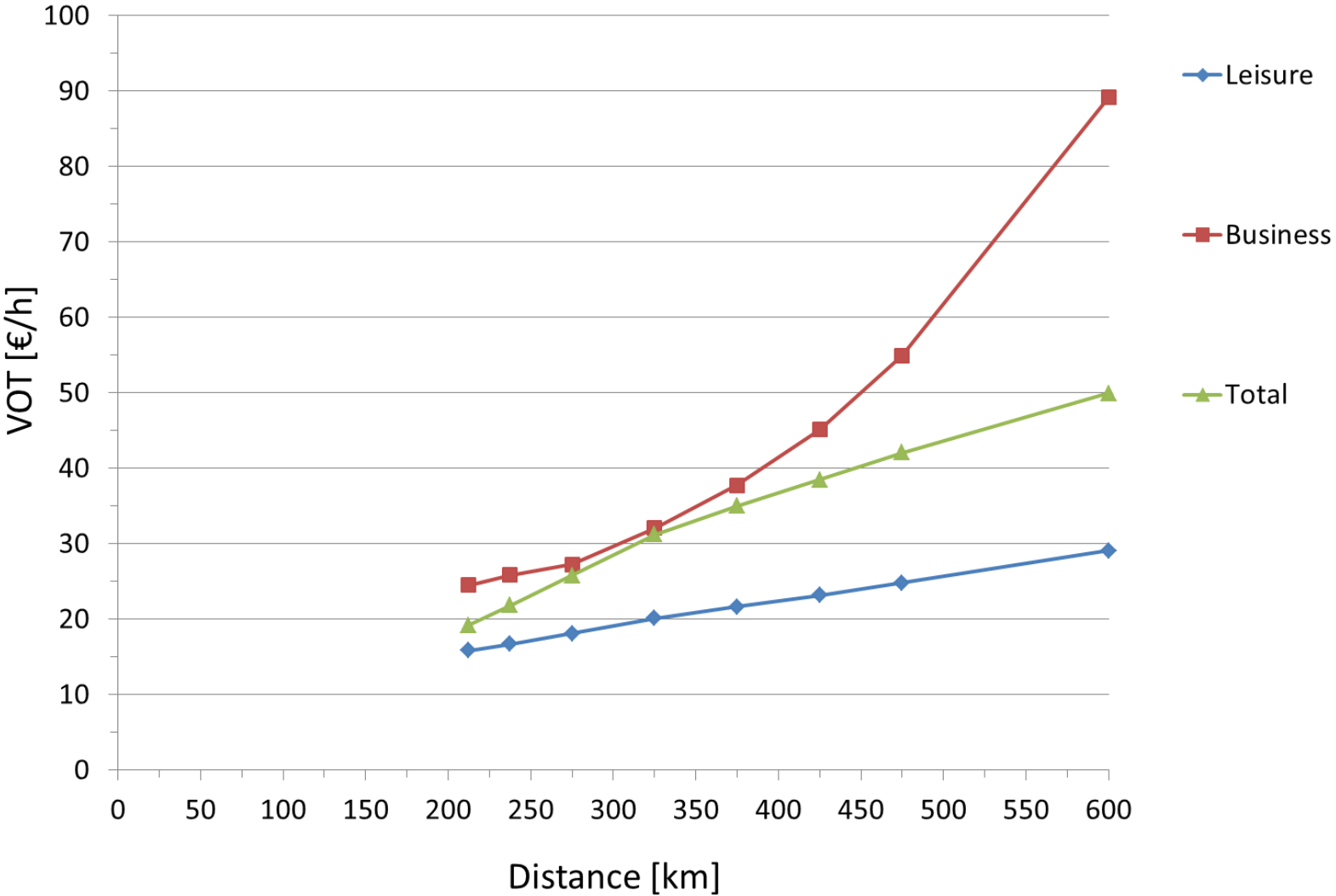
# VOT MPT by distance



# VOT PUT by distance



# VOT Air by distance





# How to treat small travel time savings?

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- utility gain clearly decreases if small travel time savings are not taken into account
  - controversial discussion, different approaches suggest different treatments
  - collected data allowed additional analysis
    - empirical test for size and sign effect
    - no effect found
    - due to complexity of the questionnaire?
- recommendation to the BMVI: treat all time savings equally.

# Value of reliability

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2 different definitions for reliability:

- standard deviation of travel time for MPT
  - mean variance approach
  - decreasing mean travel time leads to decreasing std. dev
- mean expected unscheduled delay for PUT and plane
  - product of average delay and probability of delay
  - decreasing VOT leads to decreasing VOR AND vice versa

# Reliability ratio VOR/VOT

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Trip purpose	MPT Std.dev.	PUT expect. delay	Plane expect. delay
Education	0.7	0.9	--
Commute	0.7	1.0	--
Shooping	0.7	0.7	--
Leisure	0.7	0.9	1.4
Business	0.7	1.7	1.4
Total	0.7	0.9	1.4

# Future tasks

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Periodic update of VOT and VOR

Reliability

- consistent definition
- harmonize forecasting procedure

Modeling long term value of time (workplace and residential choices)

# Questions?

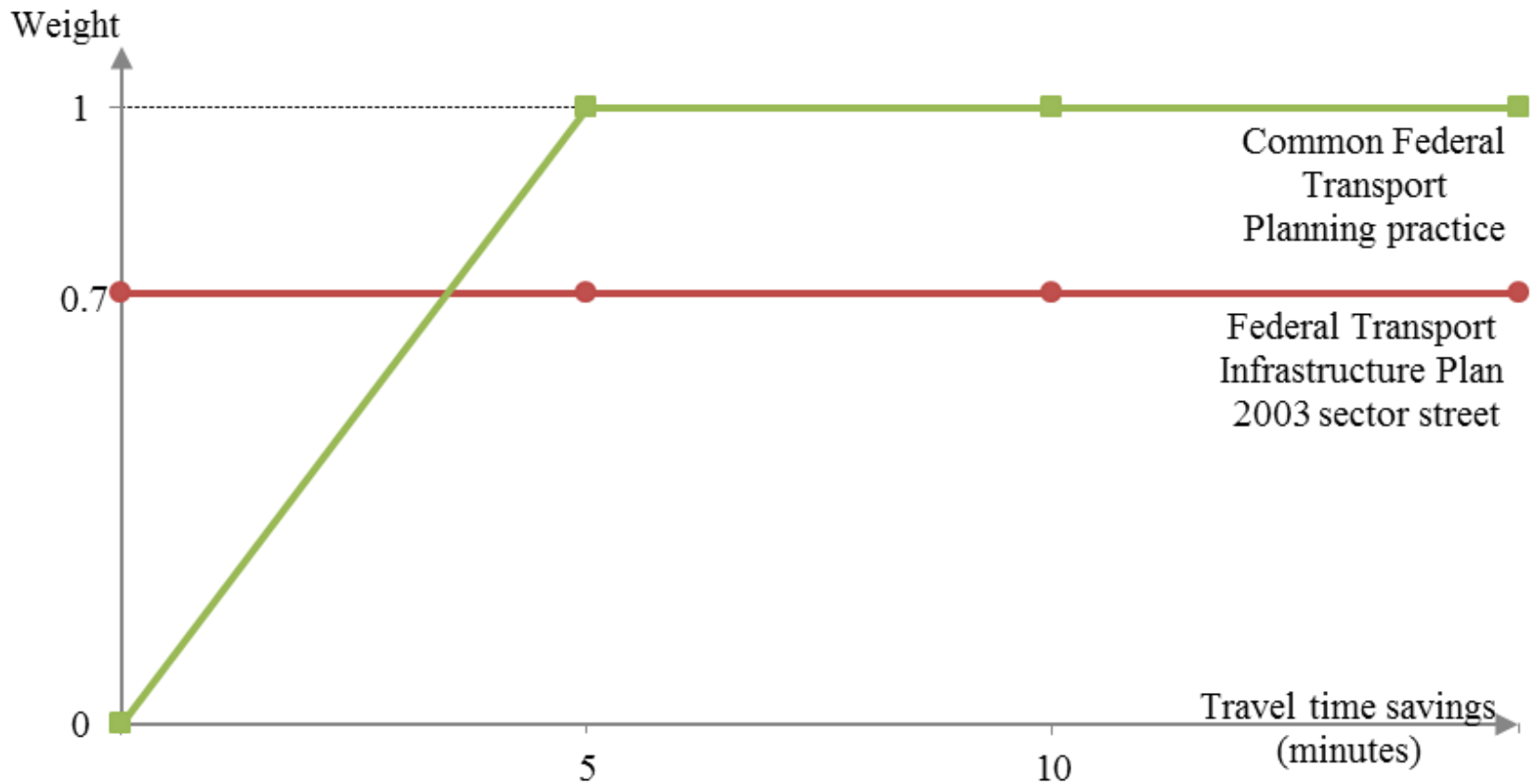
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[http://www.bmvi.de/SharedDocs/DE/Anlage/VerkehrUndMobilitaet/  
bvwp-2015-zeitkosten-pv.pdf?\\_\\_blob=publicationFile](http://www.bmvi.de/SharedDocs/DE/Anlage/VerkehrUndMobilitaet/bvwp-2015-zeitkosten-pv.pdf?__blob=publicationFile)

[www.ivt.ethz.ch](http://www.ivt.ethz.ch)

# Small travel time savings

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# Testing STTS

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$$\Delta_{TT} = \sum_{j \neq i} \frac{1}{J} \sqrt{(TT_j - TT_i)^2}$$

Difference between travel time

$$\beta_{TT} \left( \frac{\Delta_{TT}}{\Delta_{TT}} \right)^{\lambda_{\Delta_{TT}}} \text{ instead of } \beta_{TT}$$

# Example SC experiment: Route choice

Verbindung 1		
Gesamtzeit	0:47	h
davon im Fahrzeug	0:33	h
davon Wartezeit	0:08	h
davon Zu- & Abgang	0:06	h
Umsteigen	3	Mal
Kosten	2,20	€
Auslastung	gering	
Verspätung bei jeder	20.	Fahrt

Verbindung 2		
Gesamtzeit	0:42	h
davon im Fahrzeug	0:33	h
davon Wartezeit	0:03	h
davon Zu- & Abgang	0:06	h
Umsteigen	2	Mal
Kosten	1,80	€
Auslastung	hoch	
Verspätung bei jeder	5.	Fahrt

Wahl:



# Interviews with decision makers

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- main mode car (80%)
  - mobility concepts are optimized to time and cost
  - about 20% of employees of a company are mobile and travel rather alone than in groups
  - route choice is a free decision of the employee
  - mode choice is a joint decision
- it is plausible to ask the employees

# SC – types: non-commercial respondents

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

# SC experiment: Long term residential

	Bisher	Neu
Typ der Wohnung	Einfamilienhaus	Einfamilienhaus
Größe	140 m <sup>2</sup>	134 m <sup>2</sup>
Ausbaustandard	Neubau	renovierter Altbau
Außenraum	Garten	Garten
Mietpreis / Hypothek	0 € / Monat	0 € / Monat
Art des Umfelds / Lage	auf dem Land	in einem Vorort
Fahrtzeit mit dem Auto:		
zur Arbeit	0:12 h	0:08 h
zum Einkaufen	0:02 h	0:01 h
Kosten mit dem Auto:		
zur Arbeit	43 € / Monat	34 € / Monat
zum Einkaufen	3 € / Monat	4 € / Monat
Fahrtzeit mit dem ÖV:		
zur Arbeit	0:13 h	0:09 h
zum Einkaufen	0:02 h	0:01 h
Kosten mit dem ÖV:		
zur Arbeit	43 € / Monat	36 € / Monat
zum Einkaufen	4 € / Monat	5 € / Monat
Wahl:	<input type="checkbox"/>	<input type="checkbox"/>

# Study design - characteristics mode choice

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Attribute	Levels
main mode	-30%, -10%, +20% actual state
walk	5%, 10%, 20% of travel time
congestion or waiting time	5%, 10%, 20% of travel time
cost	-20%, +10%, +30% actual state
change	-1, +/-0, +1 time
frequency	-1, +/-0, +1 step
share delayed trips	5%, 10%, 20%

# VOT Mode free by distance

