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quantitative research

Productive use of travel time, values of time and reliability in The Netherlands

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Contents of this presentation

- The three national VTT surveys for **passenger** transport in The Netherlands
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 - Main results from the 2009/2011 survey
 - Some new results on the impact of time and cost on the VTT
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- **Useful** travel time for **all purposes**
- **Changes** in the VTT over the years
 - Results so far from The Netherlands
 - Zero VTT?



But first (something to think about):

“What is a cynic?

... A man who knows the price of everything and the value of nothing.”

*Lord Darlington, Act III of Lady Windermere's Fan
(1892), Oscar Wilde*

The Dutch national VTT studies (passengers)

	1988 (en-route and mailback)	1997 (en-route and mailback)	2009 (internet panel) & 2011 (en-route recruitment and online interview)
Segments	Car Train Local PT	Car Train Local PT	Car Train Local PT Air Recreational navigation
SP experiments	<i>2 attributes:</i> Time vs. Cost	<i>2 attributes:</i> Time vs. Cost	<i>2 attributes:</i> Time vs. Cost <i>3 attributes:</i> Time vs. Cost vs Reliability

Common characteristics of all three studies

- The **goal** is standard values by mode and purpose for **CBA**
- VTTs are **escalated** using an **income elasticity** of the VTT, but this may not properly capture structural changes
 - Hence the requirement to **redo** the VTT study every ten years or so
- Reliance of **WTP** of travellers using within-mode **SP** experiments
- **Discrete choice** models with interaction terms for observed heterogeneity
 - 2009/2011 survey used power-law functions of (base) time and cost, and panel latent class models for unobserved heterogeneity
- Use of the **Hensher equation** for business VTT
- **Expansion** of survey results to national average values using the national travel surveys

Example of an SP choice screen (experiment 1)

■ 1988/1997:

	A	(1)	B
Reisduur	HETZELFDE	als nu	Reisduur 20 MINUTEN LANGER dan nu
Reiskosten	HETZELFDE	als nu	Reiskosten f 2,00 LAGER dan nu

Note: no reference value,
Changes only with respect to "As Now"

■ 2009/2011:

Welke rit heeft uw voorkeur?

Rit A
Gebruikelijke reistijd:
60 min.
Kosten:
€ 2.80

Voorkeur voor Rit A

Rit B
Gebruikelijke reistijd:
45 min.
Kosten:
€ 3.60

Voorkeur voor Rit B

Example of an SP choice screen (experiment 2a)

Welke rit heeft uw voorkeur?

2 / 7

Rit A

Vertrektijd:
08:10

U heeft een even grote kans op elk van deze 5 reistijden en dus om op deze tijdstippen aan te komen:

Reistijd:	->	Aankomsttijd:
25 min.	->	08:35
35 min.	->	08:45
35 min.	->	08:45
55 min.	->	09:05
75 min.	->	09:25

Gebruikelijke reistijd:
35 min.

Kosten:
€ 1.80

Voorkeur voor Rit A

Rit B

Vertrektijd:
08:00

U heeft een even grote kans op elk van deze 5 reistijden en dus om op deze tijdstippen aan te komen:

Reistijd:	->	Aankomsttijd:
35 min.	->	08:35
45 min.	->	08:45
45 min.	->	08:45
55 min.	->	08:55
65 min.	->	09:05

Gebruikelijke reistijd:
45 min.

Kosten:
€ 2.80

Voorkeur voor Rit B

Main results: VTT in euro/hour (2010 prices)

	Car	Train	Bus, tram, metro	All surface modes	Air	Recr. Navigation
Commute	9.25	11.50	7.75	9.75		
<i>Business employee</i>	12.75	15.50	10.50	13.50	85.75	
<i>Business employer</i>	13.50	4.25	8.50	10.50	-	
Business	26.25	19.75	19.00	24.00	85.75	
Other	7.50	7.00	6.00	7.00	47.00	8.25
All purposes	9.00	9.25	6.75	8.75	51.75	8.25

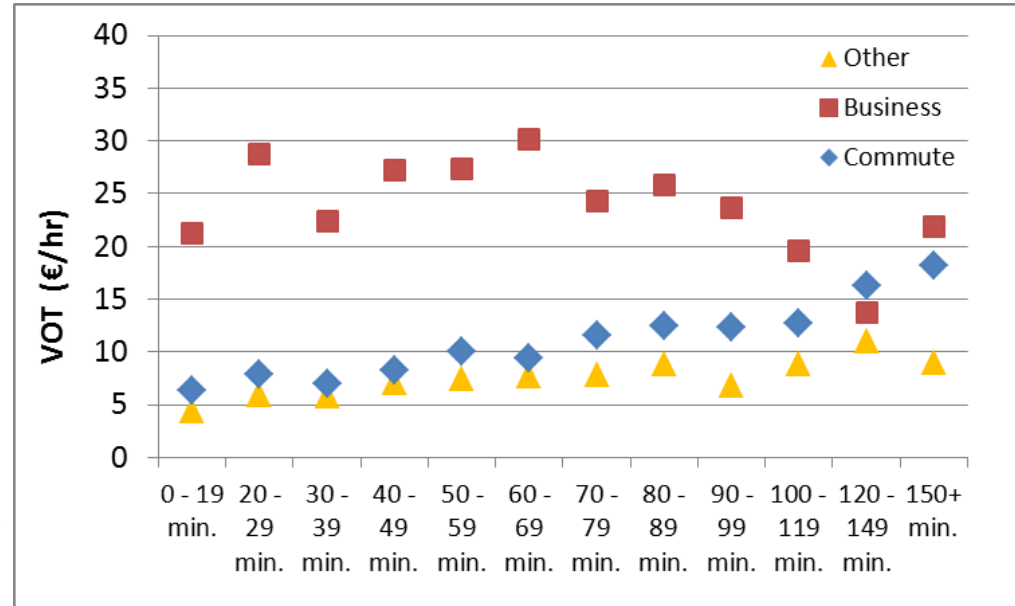
Main results: reliability ratios

(standard deviation relative to time)

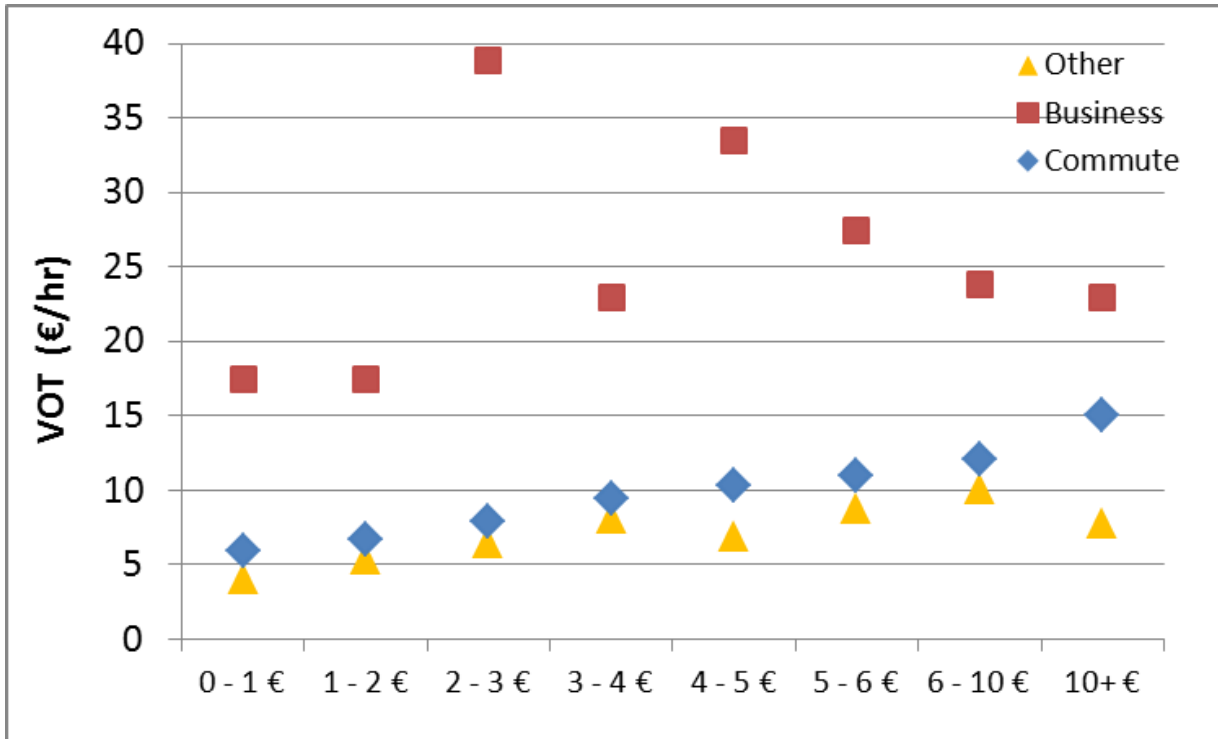
	Car	Train	Bus, tram, metro	All surface modes	Air	Recr. Navigation
Commute	0.4	0.4	0.4	0.4		
Business	1.1	1.1	1.1	1.1	0.7	
Other	0.6	0.6	0.6	0.6	0.7	0

The impact of base time on VTT (new results)

- Trip distance is not an explanatory variable in the model
- Time and cost of the reference trip are (in a non-linear way)
- Also indirect effect from other explanatory variables
 - High income respondents make on average longer trips and have higher values-of-time
- Sample enumeration shows total effect



The impact of base cost on VTT (new results)



Productive travel time and the Hensher equation



Underlying micro-economic theory

Based on DeSerpa (1971), McFadden (1981) and Jara-Diaz (2008) we define the Value of Travel Time (VTT) for project appraisal as:

$$\text{VTT} = \frac{\mu}{\lambda} - \frac{\left(\frac{\partial U}{\partial T}\right)}{\lambda}$$

Utility at origin or destination

Utility while travelling, e.g. work during trip

Where does time gain go to? Employer or employee?

How much trip time is spent working?

How productive is working during trip relative to the workplace?

μ = Lagrangian multiplier of the time constraint
 λ = Marginal utility of income;
 U = Direct utility;
 T = Travel time

Fraction of saved time that would be spent working (business trips)

	1988	1997	2011
Car	0.67	0.54	0.56
Train	0.47	0.37	0.38
BTM	0.53	0.34	0.54
Airplane			0.21
Total	0.63	0.50	0.51

Fraction of trip time spent working (business trips)

	1988	1997	2011
Car	0.02	0.04	0.04
Train	0.11	0.16	0.16
BTM	0.03	0.03	0.06
Airplane			0.14
Total	0.03	0.06	0.06

Productivity of work during travel

(relative to work at the workplace; business trips)

	1988	1997	2011
Car	0.90	0.93	0.91
Train	0.89	0.90	0.94
BTM	0.93	0.89	0.83
Airplane			1.00
Total	0.89	0.92	0.91

Useful travel time (all trip purposes)



Some background questions on useful travel time

(2009/2011 survey; all purposes)

- Which **devices** did you have available during the trip?
 - mobile phone
 - computer, laptop, Blackberry, etc.
 - music player (radio/CD/Ipod/ etc.)
 - other

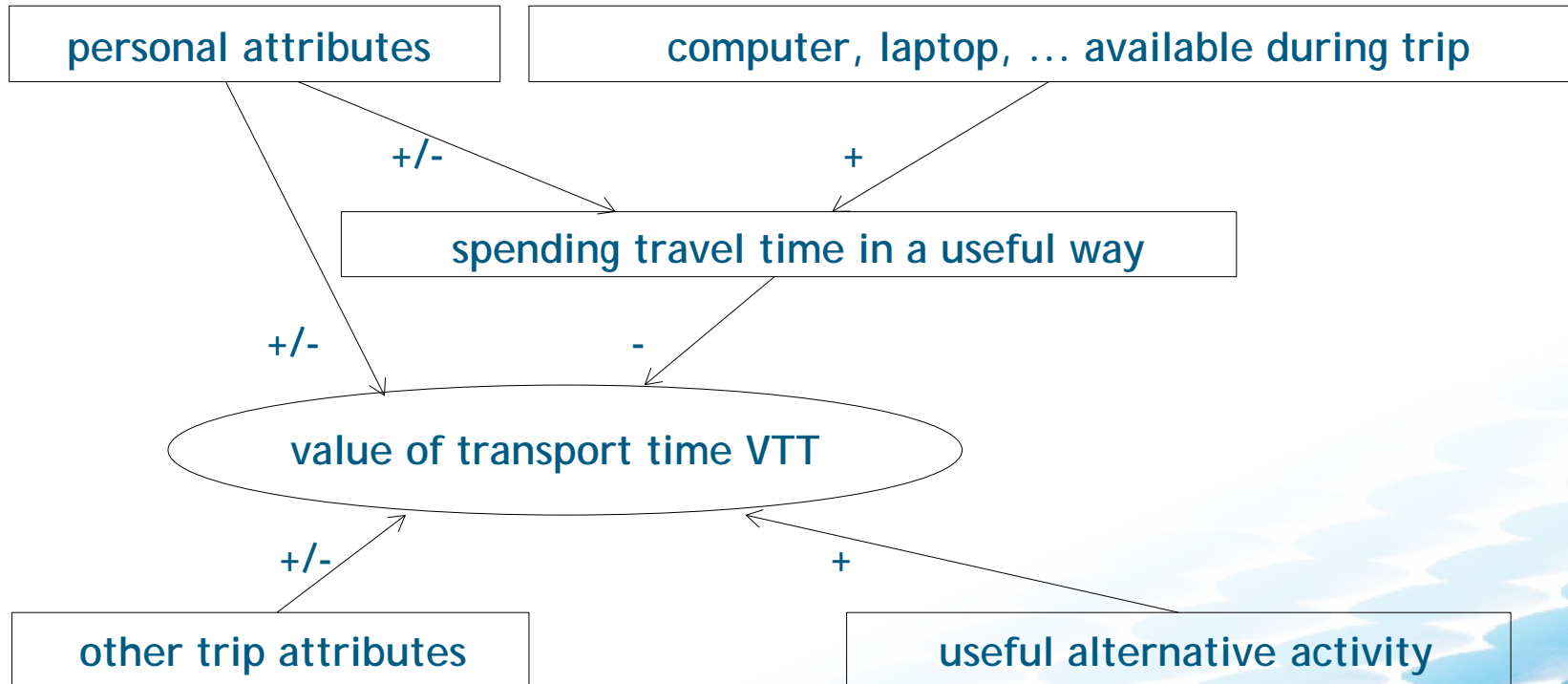
- Could you spend the travel time in the vehicle **usefully** (yes, no)?

- Which activity would the respondent have carried out in case of a **shorter** trip duration (by a certain amount)?
 - Would such a **shorter** trip duration be **useful**?

- Which activity would the respondent have reduced (or not carried out) in case of a **longer** trip duration (by a certain amount)?
 - Would such a **longer** trip duration be an **annoyance**?

The estimated model

(further analysis on the 2009/2011 VTT survey data)



Main findings on useful travel time

- If a shorter travel time is useful / a longer travel time is an annoyance, the VTT **increases** by approx. **20%**
 - Travel time can be replaced by a more useful activity
 - Applies to all modes, all purposes
- If travel time can be spent in a useful way, the VTT **decreases** by approx. **20%**
 - Only for train and local public transport
- The availability of computers during a trip has **reduced** the VTT by approx. **2%**.
 - If **everybody** would have a computer available during the trip, the VTT will be reduced by another **1%**

Change in the value of travel time over the years



VTT over the years

Earlier results on the longitudinal income elasticity of the VTT

■ Meta-analysis

- Measure VTT and income in multiple countries and over time
- Observed values **tend to 1**
- However, do not take all differences between studies into account (i.e. design and utility specification)

■ Longitudinal comparisons

- Measure VTT and income at multiple moments in time in a single country
- Use same analysis method for both years
- Few studies exist (Gunn, 2001; Tapley et al., 2007; Börjesson et al., 2012)
- Gunn (2001) compared the **Dutch** studies of 1988 and 1997
 - Over time VTT grows less than income (income elasticity of **0.5**)
 - Suggested this has to do with productive use of travel time (increasing through ICT)

Comparing studies of 1997 and 2009/2011

- New material for Sweden and The Netherlands was presented at ICMC 2017 (Kouwenhoven, Börjesson, Daly and de Jong)
- For The Netherlands, this compared the studies of 1997 and 2009/2011
- For **most** mode-purpose combinations the real VTT goes **up**
 - But **not** by as much as income does
- For **some** mode-purpose combinations the real VTT even goes **down**
- This is related to **productive use** of travel time and **ICT** developments



Are we going to zero VTT? - I

- “It is difficult to make predictions ...



Are we going to zero VTT? - I

- “It is difficult to make predictions ...
especially about the future”

Danish proverb



- “It is far better to foresee even without certainty than not to foresee at all.”

Henri Poincaré, French mathematician, 1854-1912

Are we going to zero VTT? - II

- ICT developments have made working in the train **almost as productive** as working at the workplace (factor 0.94)
- **Automated vehicles** could also make this possible in the **car**
 - And car would be quieter and not crowded
- But another requirement for zero VTT is that we **work all the time** we travel
 - Only 16% of travel time in the train is spent working by business travellers
- Some travel time cannot be converted to work (finding a seat in the train, time in crowded conditions)

Are we going to zero VTT? - III

- On the other hand, travel time spent for other uses than work can also yield utility
 - But on average this has a lower value than working
- So, large changes in the **how we spent** travel time are required for zero VTT
- It's likely that VTT will **not increase** as much as income or will even **decline**
- So, time escalation factors of (close to) 1 should be **reconsidered**

Thank you for your attention!

Any questions?

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