# Estimating Values of Time on National travel survey data

## *Background and scope*

The Value of Travel Time (VTT) is fundamental in transport economics. Since 1984 (MVA et al., 1984) best practice for VTT estimation has been to use Stated Choice (SC) data. However, there is now plenty of evidence of reference dependence and gain-loss asymmetry in SC data, implying that such data do not reveal long-term stable preferences. This is a serious problem since the value of time is often applied in welfare analyses, where long-term stability of the preferences is a key assumption. A potential reason for the strong reference dependence found in SC data is the emphasis on a short-term reference point often used in SC data to reduce hypothetical bias. In the long-run there is no stable reference point. Also, the use of Stated Choice data always raises the issue of the credibility of hypothetical responses.

An alternative to SC data is to use revealed preference (RP) data and a mode choice model to estimate the VTT. Observed behaviour has adapted to the (more stable) travel conditions and should thus be ruled by more long-term preferences. Many countries collect NTS (national travel survey) data and spend considerable resources on making them representative, which is an argument for using them for VTT estimation. However, a key problem in the use of NTS data for VTT estimation is measurement errors in the travel time and travel cost variables. Time and cost in NTS data is either self-reported or derived from a network assignment model.

In this paper we estimate the distribution of the VTT whilst controlling for errors in the self-reported and model computed time and cost variables.

7th Symposium of the European Association for Research in Transportation

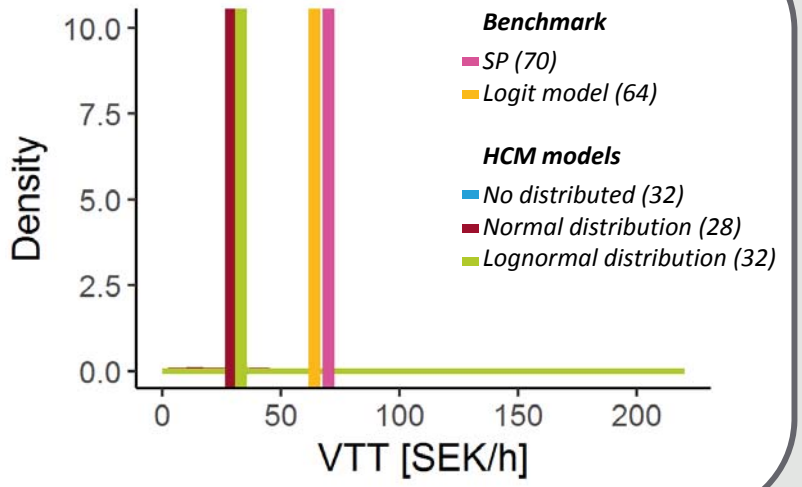
*- 6th Sept 2018 -*

## Results

### Data

- Swedish NTS 2006
- Work & school commute (3777 observations)
- TransCad network to calculate Level of Service attributes of the alternatives

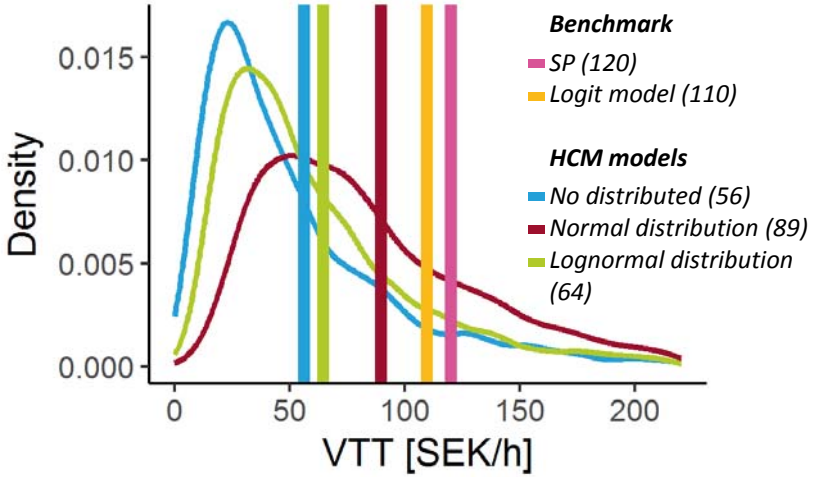
### VTT distribution - Public Transport



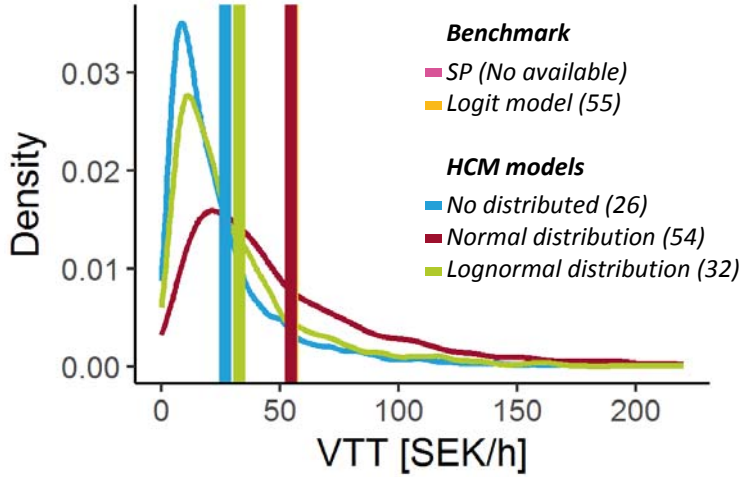

| Model (Log-likelihood) | VTT no distributed (-55274.792) | | VTT – Normally distributed (-67981.95) | | | VTT – LogNormally distributed (-67952.232) | | |
|---|---|---|---|---|---|---|---|---|
| WTP Parameters | Value | t-test | Value | t-test | | Value | t-test | |
| $\mu_{car\ driver}$ | 0.0341 | | 0,0594 | | | -3,17 | | |
| $\sigma_{car\ driver}$ | - | - | 0,0009 | | * | 0,054 | | * |
| $\mu_{car\ passenger}$ | 0.0388 | | 0,0874 | | | -3,04 | | |
| $\sigma_{car\ passenger}$ | - | - | 0,0313 | | | 0,256 | | * |
| $\mu_{PT}$ | 0.04 | | 0,0459 | | | -3,22 | | |
| $\sigma_{PT}$ | - | - | 0,0043 | | * | -0,042 | | * |

* Parameter not statistically different from zero at 95% confidence

### VTT distribution - Car Driver




### VTT distribution - Car Passenger




*Vertical bars show the mean value of the estimated distributions. Numeric values are provided in the legend between brackets.*

**Authors:**

**Juan M. Lorenzo Varela**
*KTH / CTS*
**Maria Börjesson**
*vti*
**Andrew Daly**
*University of Leeds*

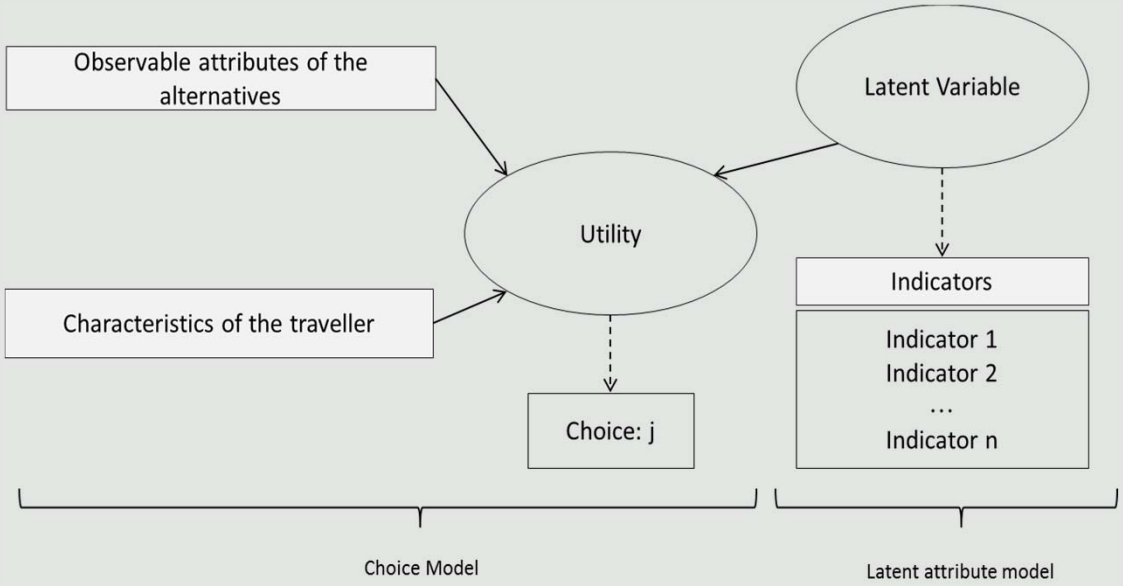

**Scan me & read me later!**

*(References included in the QR version)*

## Methodology

To estimate the distribution of the VTT whilst controlling for errors in the self-reported and model computed time and cost variables, we treat travel time and travel cost as latent variables in the estimation of a mode choice model.

*Hybrid Choice Model formulation*




$$L(j, I|\beta, \theta, \lambda) = \int \underbrace{P(j|\beta, X, X^*)}_{\text{Choice model}} \underbrace{f_M(I|X^*; \lambda)}_{\text{Measurement eq.}} \underbrace{f_{X^*}(X^*; \theta)}_{\text{Structural eq.}} dX^*$$

## *Conclusions*

- Time and cost variables normally used in mode choice models, whether reported or derived from networks, carry errors with them; hence, parameter estimates are diluted and biased.

- Estimated error distributions show that residuals for cost variables exhibit much larger variance than do time variables. This suggests that cost parameters incur larger errors than time parameters. *(Lorenzo et al. 2018 - Quantifying errors in travel time and cost by latent variables)*

- When estimating a distributed VTT, we observe a reduction of its variance, when compared against an identical model specification that does not control for measurement errors in the input variables (time and cost).

- We find that means of the estimated VTT distributions are reasonably robust to the modelling assumptions.

- Models not accounting for measurement errors yield higher values of time than the models with latent variables.

- VTT estimates from specifications with latent values yield lower estimates than current VTT from SC data used in appraisal.