



# THE EFFECT OF TIME PRESSURE ON TRAVELLERS' ACTIVITY-TRAVEL DECISION-MAKING

## Introduction

It is widely acknowledged that time pressure is often present when travellers make sometimes very complex choices between competing sequences of activity-travel patterns. Therefore it is important for modellers to take into account the possible impacts of time pressure on traveller decision-making. This paper aims at integrating the notion of time pressure in discrete travel choice models, by means of introducing decision time-related scale heterogeneity of the error component into the conventional Random Utility Maximization-formulation of discrete travel choice behaviour. Theoretical analyses are presented to illustrate model properties and to gain insight into how the model predicts that time pressure may affect the (outcomes of) discrete travel choice processes. A synthetic dataset is created to test the model.

## Model Structure

The utility of Alternative  $i$  for Individual  $n$  has the following expression:

$$U_{nt} = \mu_t \beta_n x_{nt} + \varepsilon_{nt}$$

e.g. the scale  $\mu_t = \frac{t}{\alpha + t}, t > 0$

$t$  means time duration for decision making

$\alpha$  is the time - associated parameter

$\varepsilon_{nt}$  is the normalized error

By using a specified discrete choice model, the parameters associated with traveller tastes and decision time can be estimated simultaneously. An example of MNL model is shown below:

$$P_n(i) = \frac{e^{\beta_i \beta_n x_{ni}}}{\sum_{i=1}^k e^{\beta_i \beta_n x_{ni}}}, i = 1, 2, \dots, k$$

$$P_n(i) = \frac{\frac{t}{\alpha + t} e^{\beta_i \beta_n x_{ni}}}{\sum_{i=1}^k \frac{t}{\alpha + t} e^{\beta_i \beta_n x_{ni}}}, i = 1, 2, \dots, k$$

## Synthetic Data and Model Result

A three-travel-alternative synthetic data of 4000 samples has been created to test two MNL models, one without the decision time-related scale heterogeneity and one with. The result shows that if the effects of time pressure exists in the data, models that fail to take it into account will result in biased parameter estimation, although the ratio of the parameters remains unaffected.

	MNL Model without Scale Heterogeneity			
	$\beta_{time}$	$\beta_{cost}$	$\beta_{comfort}$	$\alpha$
Value	-0.374	-0.639	0.134	n/a
T-test	-33.64	-37.83	-15.46	n/a
Rho			0.450	
Rho-adj.			0.449	
Log-likelihood			-2418.1	
	MNL Model with Scale Heterogeneity			
	$\beta_{time}$	$\beta_{cost}$	$\beta_{comfort}$	$\alpha$
Value	-0.592	-0.962	0.179	23.1
T-test	-27.54	-28.99	14.92	5.89
Rho			0.552	
Rho-adj.			0.551	
Log-likelihood			-1969.2	