



## Preferences for travel time variability – A study of Danish car drivers

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*Publication date:*  
2014

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*

Hjorth, K., & Rich, J. (2014). Preferences for travel time variability – A study of Danish car drivers. Abstract from 3rd Symposium of the European Association for Research in Transportation, Leeds, United Kingdom.

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## **Abstract for hEART2014**

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### **Extended Abstract**

Travel time variability (TTV) is a measure of the extent of unpredictability in travel times. It is generally accepted that TTV has a negative effect on travellers' wellbeing and overall utility of travelling, and valuation of variability is an important issue in transport demand modelling and in appraisal of transport and infrastructure projects. The effect of TTV has been analysed in several methodological papers and empirical studies (see, e.g., the review in Carrion and Levinson, 2012). Most methodological research is based on the premise that the value of TTV is closely linked to travellers' trip scheduling preferences – their preferences for departing and arriving at given times of day.

In this paper, we present the design of a new Danish stated preference (SP) survey regarding TTV and the choice of departure time. We analyse data from a pilot survey using a scheduling model proposed by Engelson and Fosgerau (2011). Our objective is to check if travellers' preferences are consistent with the theoretical model and to estimate a monetary value of TTV.

The survey is part of the development of a new national Danish traffic model, and the main part of the data collection is to take place in the spring 2014. The results presented here stem from a pilot study from December 2013, yielding 111 interviews for analysis. Overall the results are encouraging and the survey will be launched with only minor changes.

Rather than being representative of the population, the aim of the survey is to aid the development of an appropriate scheduling model to use in the valuation of TTV. We therefore focus solely on morning commute trips for car drivers who are used to commuting to work in congested conditions. This is to achieve a relatively homogenous sample of travellers and trips in terms of scheduling preferences, to exclude non-traders, and to avoid complicated issues related to scheduled public transport services.

The survey uses customised Internet questionnaires, containing a series of questions related to the traveller's most recent morning trip to work, e.g.:

- Travel time experienced on this day,

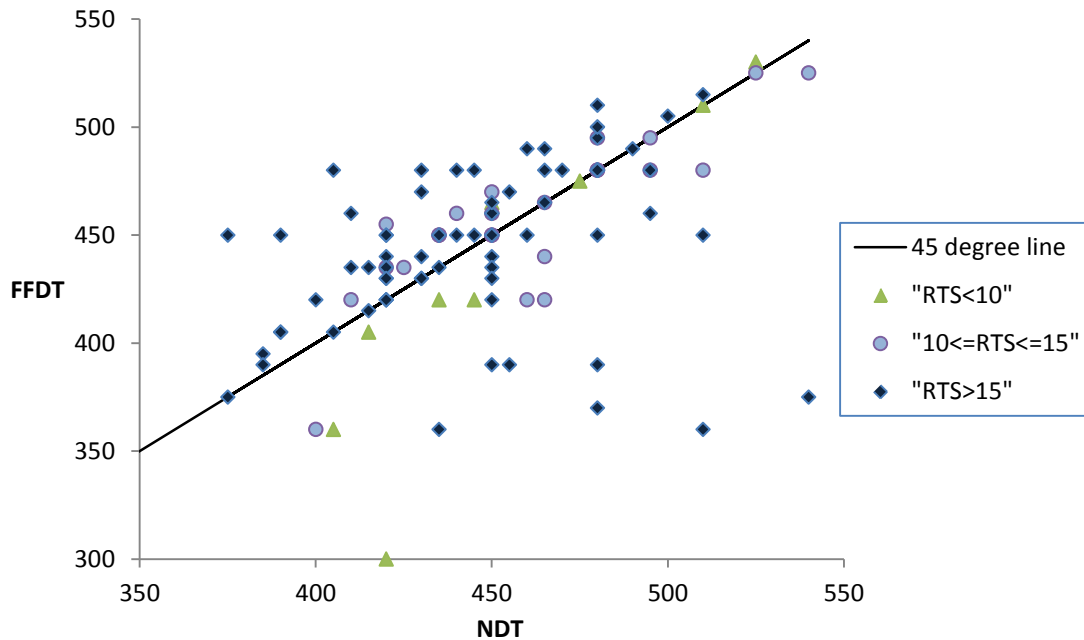
- Number of stops along the way, their duration, and whether these stops involved restrictions on time of day,
- Restrictions regarding departure time from home or arrival time at work,
- How often such a trip was made within the last month and the range of experienced travel times,
- What the traveller considers to be his “normal” travel time and departure time,
- What the traveller considers to be his free flow travel time (without queues or congestion), and his preferred departure time in the hypothetical situation where there were never queues or congestion.

The survey contains two SP games, each consisting of 6 binary choices. The first game involves trade-offs between travel time, TTV and monetary travel cost, while the second also includes departure time. An overall aim in the survey is to keep the SP trade-offs as simple as possible, and hence TTV is described using travel time distributions that can attain only two values, a low value with probability  $(1-p)$  and a high value with probability  $p$ . We deliberately avoid the phrasing of travel times as “normal travel time” and “delay”, to minimize effects of potential reference-dependence and loss aversion (Kahneman and Tversky, 1979). Attribute levels are determined using an orthogonal and partly randomised design rather than an “optimised design”. This is due to robustness considerations since the optimised design requires the true scheduling model to be known in advance. The effects of assuming a wrong “true” model are not sufficiently clear.

As a first step in our analysis, we use the information about “normal” departure time (NDT) and preferred free flow departure time (FFDT) to check whether the basic premises of the theoretical models hold. These premises predict that travellers react to TTV by moving their departure time away from the peak hours. As a result we expect that a large share of the respondents travelling outside the peak would actually prefer to travel during the peak, if there were no TTV. Hence FFDT should be later than NDT for trips before the peak and earlier than NDT for trips after the peak. This pattern is confirmed by our data, and is particularly clear for respondents who are used to travel time varying by more than 15 minutes (see Figure 1). The majority of the respondents (70%) depart between 7AM and 8AM, and the general tendency is that people who travel early (depart before 7AM) would prefer to travel later if there were no congestion, while people who travel late (depart after 8AM) would prefer to travel earlier if there were no congestion.

The relation between FFDT and NDT does not seem to differ between respondents with fixed work start time and respondents without. Neither do we see an effect of having restrictions on arrival time (how late one can arrive) or restrictions on departure time (how early one can depart) – however, the evidence regarding the latter is sparse.

**Figure 1: FFDT and NDT (unit: minutes past midnight). RTS is the experienced travel time variation (diff. between max and min, in minutes).**



The next step in our analysis is to estimate a value of TTV (VTTV) using the data from the SP games. In line with Börjesson et al (2012), we estimate two models: One assumes that departure time is not optimally chosen (the model with scheduling preferences), and so the traveller's utility is a function of both the travel time distribution and the departure time. This model is estimated using a discrete choice model with the SP data with a departure time attribute. The other model assumes departure times are optimally chosen (reduced form), so that the traveller's utility is solely a function of the travel time distribution. This model is estimated using a discrete choice model with the SP data without a departure time attribute. In both models TTV is measured by the travel time variance.

The results based on the pilot data for the model with scheduling preferences yields a high value of travel time (VTT) of 0.34 Euro/minute (approx. 20 Euro/h) which is to be expected given our high-income sample. The VTTV is extremely low, however, at 0.0002 Euro/minute<sup>2</sup>. The reduced form model yields a similar VTT of 0.32 Euro/minute. The VTTV is very low: 0.006 Euro per minute<sup>2</sup>, but nonetheless more than 30 times higher than in the model with scheduling preferences. This inconsistency between the two models is similar to the one reported by Börjesson et al. (2012). When examining the VTTV further, we find that travel time variances below a certain size (approx 100 minute<sup>2</sup>) are valued at very low rates, while larger values are valued at higher rates. These findings will be elaborated on the basis of the full-scale survey.

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