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A prestudy on the value of travel time

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Abstract

The existing Danish value of travel time (VTT) and related measures are based on data dating back to 2004, which motivates this prestudy on VTT. The study reviews recent practices and advancements in data collection, estimation methods, and valuation measures, as well as gives an overview of potential data options relevant to a new Danish VTT study. Based on this, recommendations for a possible new VTT study and data collection are presented.

Background and purpose

Welfare economic appraisals of transport projects and policies in Denmark apply a set of national unit costs known as Transportøkonomiske Enhedspriser (TE). This set consists of nationally decided estimates for the most commonly used key valuation measures and input variables in appraisals of transport projects. Among these are unit costs for time attributes and related aspects of travel. These unit costs play an essential role in assessment across many contexts, e.g. the establishment of new infrastructure, improvements in accessibility and transport policies like road pricing. In addition, the value of travel time (VTT) is important for transport models. For transport projects, time savings often represent the largest part of benefits, making the valuation of these benefits essential.

The existing Danish VTT is based on data dating back to 2004. Therefore this study reviews recent practices and advancements in data collection, estimation methods, and valuation measures, as well as gives an overview of potential data options relevant to a new Danish VTT study.

The prestudy seeks to answer the following six questions:

- What were the main aspects of the design and the key assumptions in the 2004 study of VTTs?
- What insights can be drawn from recent national VTT studies conducted in countries similar to Denmark and other studies relevant for a Danish context?
- Has the time use related to transport in Denmark changed from 2007 to 2023, and how can this be expected to affect the VTT?
- What is the potential for using new data sources in national-level VTT modelling in Denmark?
- What potential data sources and modelling approaches could be used to estimate a national value for travel time variability (VTTV)?
- What recommendations can be given regarding data, data collection, and modelling approaches allowing for a qualification of the current national Danish VTT measures and a possible update?

Methodological considerations for VTT

The 2004 study was based on stated preference (SP) data, from which estimates were derived from advanced methods developed specifically for the project. This represented the state of the art at the time, and its structure was subsequently adopted in other countries. However, since then, there have been methodological discussions related to the design of SP studies, and new data sources have emerged that make it possible to analyse VTT based on revealed preference (RP) data.

RP data describe choices in a transport system in real life settings. This use of RP data comes both with benefits and potential issues. The main arguments for using RP data are:

1) the data consist of real-life choices where individuals take their actual implications of their choices into account; 2) modern technology allows for large datasets to be collected with many alternatives and many attributes. There are, however, also problems related to using RP data: 1) it is most often unknown what attributes are taken into account by decision makers, especially what costs they consider for each alternative; 2) cost and time are often highly correlated across travel choices; 3) socio-economic variables are rarely included in data collected by new technology; making it difficult to scale results to a target population, 4) the sampling can be an issue if RP data are collected by a specific technology since this could affect representativeness and induce self-selection.

SP data consist of information of hypothetical choices in experimental settings, e.g. the 2004 Danish national VTT study, DATIV. SP data are used, when relevant RP data are not available. They describe how a respondent say they would choose among some alternatives where these alternatives varies in terms of cost and other attributes. For example, respondents may choose between two alternative car routes, each characterised by travel time and cost. The use of SP data comes with both benefits and problems. The main arguments for using SP data are 1) the attributes, especially costs, can be defined within the choice situation, which allows to cleanly isolate the effects of costs on choice from the influence of other factors 2) the correlation between time and cost can be controlled, and 3) background variables of respondents can easily be collected in combination with the collection of data on their choices. There are, however, also issues with SP data: 1) choices are hypothetical, so the framing of the survey matters for the validity; 2) it has been shown that in

DATIV, the final VTT values depend on the design decisions concerning time differences between alternatives; 3) the sampling can be an issue if the decision to participate in the survey is correlated with the VTT. An extra argument for including SP data in a new study is that these data are comparable to the data from the DATIV study. Even though these data will not be an exact replication, they will still be very similar, allowing for an assessment of potential sources for changes in the VTT over time.

Recent SP experiences in national VTT studies

The review covers recent experiences from the UK, Norway, and the Netherlands. In all three countries the national VTT measures were estimated based on SP data.

Potential RP data for VTT analysis

The prestudy analyses potential RP data available in a Danish context. The most promising data sets are briefly presented below.

Floating cars data - GPS trajectories of cars

Modern cars often track the driving, including GPS-trajectories of trips. This data can provide insights into the route choices of car drivers, including their speed, as well as the time and date of their trips. Such datasets are typically very large, potentially containing millions of observations of actual behaviour of car drivers travelling through the large road network. The size of the datasets typically also entails large coverage of the network as well as trip types (short/long trips, all periods of the day, etc.). An additional benefit of the extent of the data is also that it facilitates using the detailed GPS-position and -time logs to calculate reliable time-of-day dependent travel-time components (free time, congested time as well as travel time variability) on the network and use this in the estimation of the VTT.

An example of this type of data in the Danish context is provided by Connected Cars (connectedcars.dk). Such data can be used to estimate VTT for car occupants by analysing their choices between faster, more costly routes and slower, less costly alternatives.

The large-scale road pricing experiment

The large-scale road pricing experiment in Denmark (Forsøg med vejafgifter for personbiler, 2023-2025) records GPS traces of car trips made by participating families. By the time the data collection concludes in mid-2025, the dataset is expected to include GPS traces from approximately 2,000 families, each recording their trips over the course of a year, totalling around 800,000 trips.

The main feature of this data set is that participants incur monetary costs for driving, with the fare amount depending on the road location (city centre, suburb, or national zone) and the time of day (peak or off-peak hours). Since these costs vary over time for each family and differ randomly between families, this data set offers new opportunities to estimate VTT based on revealed preferences. In addition, a survey of participants provides detailed background information, which can be further enriched by linking the data to the Danish register data.

The Danish National Travel Survey

The Danish National Travel Survey contains travel choices collected over a single day based on approximately 218,000 interviews and has been conducted in its current format since 2006. The data set includes background information on participants. These data can be used to estimate VTT based on the mode choices of the respondents.

Smart card data - Rejsekortet A/S

Data from Rejsekort A/S can provide individual-level information on the chosen route, trip duration, and fare for passengers using the smart card Rejsekortet. These data can be used to estimate how passengers value (relatively) components such as waiting time and crowding.
The lack of background characteristics can be addressed by conducting a survey among users of smart cards that would also allow registration of access and egress travel. Such data would allow for estimation of relative weights. A combination of these data with a survey would allow for an analysis that could validate results derived from SP or TU data.

Concluding remarks

In brief, we recommend including both SP and RP data in a new valuation study of travel time and travel time variability. We suggest using

- both RP, e.g. connected cars, and SP data to assess the VTT and related measures for car
- both RP, e.g. TU data, and SP data to assess the VTT and related measures for public transport
- SP data to assess the VTT and related measures for active modes
- both RP, e.g. connected cars and TU data, and SP data to assess the VTTV for both car and public transport if resources allow for this

Both data types have advantages and disadvantages but complement each other. Thus, a combination will contribute to a more robust analysis of VTT.