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The Danish Value of Time Study

Data description

Fosgerau, Mogens; Hjorth, Katrine; Vincent Lyk-Jensen, Stéphanie

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DANMARKS TRANSPORTFORSKNING

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Note 4
2007

Mogens Fosgerau
Katrine Hjorth
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By Mogens Fosgerau, Katrine Hjorth, Stéphanie Vincent Lyk-Jensen

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Preface

Larger Danish transport projects are routinely subjected to cost-benefit analysis. For most infrastructure investments, the time savings evaluated by the value of travel time constitute the major part of user benefits. Thus, the value of travel time is often decisive for whether a project yields a positive or a negative economic benefit. It is therefore vital that the value is not only sound but also credible as its impact lies in the information that is given to policy makers concerning the projects analysed.

As a consequence, The Ministry of Transport and Energy has asked the Danish Transport Research Institute to carry out a study, leading to new values for travel time to be incorporated into the Ministry's guidelines for economic appraisal of transport projects.

Leading up to the present study was first a pre-study that lead to a phase 1 study in which a dataset was designed and collected. The present phase 2 study undertakes the econometric analysis of the data, leading to the value of travel time estimates to be used in future project evaluation.

The current note presents descriptive statistics for the data used in phase 2. Detailed documentation is available in three other notes covering various parts of the study. A report also presents an overview of the methodology and summarises the main findings. These notes and report are available from DTF's home page.

Kgs. Lyngby, 2007

Niels Buus Kristensen
Director

Contents

1 Introduction

The Danish value of time study launched by the Ministry of Transport and Energy encompasses three phases:

Phase 0: A preliminary study determining the methodology and providing recommendations for data collection and analysis[1].

Phase 1: Data collection and preliminary analysis.[2]

Phase 2: Establishment of the official value of time.

Phase 1, called DATIV (Danish Value of Time in Danish) has been realised by a consortium composed by TetraPlan, Rand Europe and Gallup. The output of Phase 1 is a data set of around 7000 Stated Preference (SP) interviews together with some preliminary analyses and a weighting procedure, designed to obtain representative values for the whole Danish population.[3]

Phase 2 is carried out by The Danish Transport Research Institute (DTF) and concentrates on the statistical and economic analysis. The output is official values of time to be used in cost benefit analysis of transport projects.

This note presents descriptive statistics for the data used in Phase 2. Section 2 presents details on the sampling of respondents and the experimental design, while Section 3 describes the different steps in the data cleaning/checking. Section 4 presents the statistics of respondents, their trips, and the SP design. Section 5 concludes the note.

[1] See Danish Transport Ministry (2003) and Fosgerau and Pilegaard (2003).
[2] See Danish Ministry of Transport (2005).
[3] See TetraPlan: "Opregningssystem for SP-interview I tidsværdistudiet", document no. 1100651-024.

2 Survey

Data for the Danish Value of Time Study origin from a stated preference survey carried out by TetraPlan, Gallup and Rand Europe in 2004.

2.1 Sampling

Interviews were undertaken with travellers between 16 and 89 years of age. A large part of the interviews were carried out on the Internet. People were recruited for Internet interviews through Gallup's Internet Panel G@llupForum; a sample that with regard to socio-demographic characteristics is representative of the population aged 15-59. In this way Internet based interviews were supposed to cover the 75% of the Danish population who have Internet access at home. Face-to-face computer-assisted interviews were carried out with people from socio-demographic groups that were not well represented in the Internet Panel (e.g. older people). These were recruited among people who belong to Gallup's representative sample[4] and do not have Internet access at home.

In the survey design interviews were segmented by mode, purpose, and trip length. In order to guarantee enough observations in each segment, quotas were imposed on the number of interviews.

In order to fulfil the sampling quota for education purposed trips, additional interviews were conducted at schools and educational institutions. Also, ferry interviews were conducted on board fast ferries.

2.2 Experimental design

In the survey, respondents were first asked to list all trips they had made within the last week, by transport mode, trip purpose and trip length. Business trips were not included. Three main groups of transport modes can be distinguished:

- Car: Car drivers and car passengers. (There is no combination between car and public transport.)

[4] A sample representative of the Danish population, consisting of people who participated in Gallup's telephone interviews.

- Public transport: Bus, Metro, S-train and train.
- Ferry.

Based on the segmentation quotas, a random trip (the reference trip) was selected, and described in detail. For journeys using multiple public transport modes the **main mode** was defined as the one on which the respondent travelled the greatest distance. For ferry passengers, the main mode was ferry, regardless of the distance travelled in car/bus/train on the trip. For the remaining respondents, the main mode was simply the mode used on the reference trip.

Respondents then participated in up to four experiments:

Experiment 1: *Abstract time-cost exercise*; examines trade-offs between travel cost and in-vehicle travel time in the main mode.

Experiment 2: *Disaggregated time components*; examines trade-offs between travel cost and in-vehicle and out-of-vehicle journey components (e.g. in-vehicle times in main mode and other modes, number of interchanges, access-egress time, parking search time).

Experiment 3: *Alternative mode exercise*; considers time/cost trading for an alternative mode (i.e. not the chosen main mode). This experiment is excluded from DATIV phase 2 analysis (see Fosgerau (2005) for further explanations).

Experiment 4: *Transfer price questions* (see Fosgerau et al, 2007).

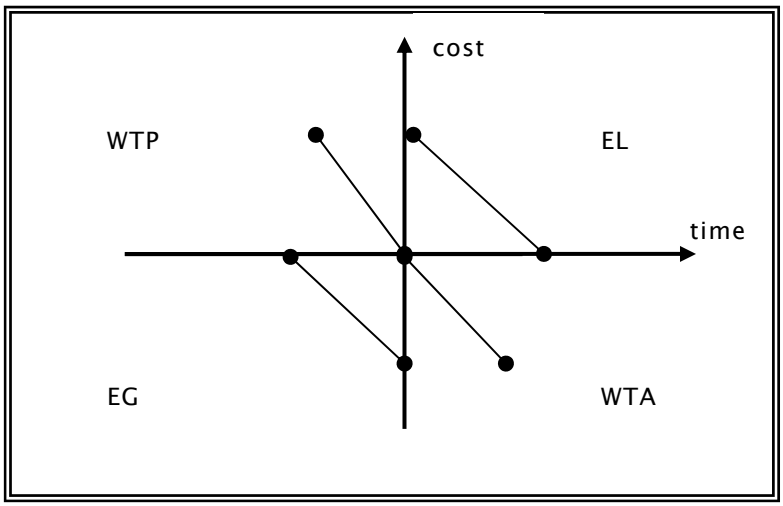
All respondents participated in experiments 1 and 4, while experiments 2 and 3 were only undertaken when deemed relevant.

2.2.1 Presentation of the first experiment (SP 1)

The first SP experiment (SP 1) examines within-mode trade-offs between travel time and cost. Respondents made a sequence of binary choices between variations of the reference trip, obtained by varying the main mode in-vehicle travel time and cost – all other characteristics were omitted and had to be considered the same as for the reference trip. For car modes, in-vehicle time was split into free flow driving time and congested driving time.

Each respondent made eight choices between a fast, expensive alternative, and a slower, cheaper one. In addition, they were presented with a choice between a fast, cheap alternative and a slow, expensive one – this dominated choice was included as a check.

The eight non-dominated choices were distributed equally on four choice types, corresponding to quadrants in the (time, cost)-plane:



Note: The dots represent the alternatives, and two linked alternatives represent a choice situation. The origin is the reference trip.

In the willingness-to-pay (WTP) quadrant, the choice is between the reference and faster and more expensive trip, while in the willingness-to-accept (WTA) quadrant the choice is between the reference and a slower and cheaper trip.

In the equivalent gain (EG) quadrant, the choice is between a gain in time or in money, while in the equivalent loss (EL) quadrant the choice is between a loss in time or in money.

2.2.2 Presentation of the second experiment (SP 2)

SP 2 consists of three different experiments: one for car drivers / passengers, one for public transport using a single mode, and one for public transport using more than one mode. Ferry passengers do not participate in SP 2. Each experiment consists of eight hypothetical binary choices between variations of the reference trip. The attributes of the alternatives are listed in Table 1 below.

Table 1: Summary of SP2

Experiment	Attributes
Car experiment	Cost, free-flow driving time, congested driving time, parking search time, egress walk time.
Single-mode PT experiment	Cost, headway, access/egress time, main mode in-vehicle time, number of interchanges and interchange wait time.
Multiple-mode PT experiment	Cost, headway, access/egress time, main mode in-vehicle time, in-vehicle time in other mode, number of interchanges and interchange wait time.

The respondents participating in the car experiment are those car drivers/passengers who are likely to experience at least one of the following components: congestion, parking search time, and egress walk time. For a given respondent, only the components that are judged to be familiar to the respondent are included in the experiment. All alternatives use the same transport mode as in SP1 (car driver or passenger).

In the single-mode PT experiment, all alternatives use the same mode, but interchanges between vehicles of the same mode type (e.g. two busses) are considered. However, the experiment uses a single in-vehicle time attribute, denoting the total in-vehicle time for all vehicles, instead of separate times for each vehicle.

In the multiple-mode PT experiment, S-train and train are grouped together in a single mode called "Train". Respondents participate in this experiment only if they use one of the following combinations on their reference trip: bus-metro, bus-train, or metro-train – and only if the main mode is one of the two. In the experiment respondents are presented both with alternatives using both modes, and with alternatives using only the first or the second mode. Alternatives using both modes always have a single interchange, while alternatives using only one of the modes have no interchanges. In-vehicle times are presented separately for the two modes. Four of the eight choices (part A) are between two multiple-mode alternatives, while the remaining choices (parts B and C) are between a single-mode alternative and a multiple-mode alternative.

2.3 Background data

Background variables are socio-demographic characteristics (e.g. age, income, sex, household status etc.) together with details of the reference trip. Missing values of personal and household income are supplemented with income information from Gallup, when available.

3 Data cleaning

3.1 General data cleaning

7,660 interviews were completed and terminated correctly, and an additional 82 interviews were judged usable (see "Data Evaluation", document no. 1100651-010). TetraPlan carried out an initial data cleaning, excluding observations where:

- The respondent is out of scope
- Segmentation is wrong (respondent has not made any trip within the assigned mode/purpose/trip length segment)
- There are multiple responses from the same respondent.
- There are errors in the presented travel times and costs (as air travel, ferry, or hotel expenses are included in the reported trip characteristics)
- The respondent stated that the interview should not be used.

7,579 respondents (with a total of 68,194 SP1-observations) remained after these exclusions. An essential part of the analysis carried out in Phase 2 was correcting for unwanted effects of the SP design, among these the influence of the value of time (VTT) implicitly presented in the first choice situation. For this reason we excluded five respondents where the record of the first choice situation was missing.

Further data cleaning was undertaken, based on recommendations from TetraPlan (see "Data Evaluation", document no. 1100651-010). Respondents were excluded if they gave unrealistic values of travel distance, main mode journey time, travel cost, calculated speed or travel group size. Furthermore car drivers were excluded if the extra travel time due to congestion was more than 70% of the total driving time, and public transport observations were excluded if the main mode travel time was less than 10% of the total travel time.

Respondents who chose the dominated alternative (the one being slower and more expensive) in the SP1 check question were excluded. Moreover, we excluded all SP1 choices with a dominant alternative regardless of the

answer – the dominated choices are only used to identify respondents with irrational answers and contain no information of the value of time, which can only be non-negative.

6,202 respondents (48,001 SP1-observations) remained after performing the exclusions recommended from TetraPlan.

In addition to these exclusions, four respondents were excluded because the stated travel time in the mode claimed to be main mode was zero, three SP1 observations were excluded because the difference in travel time between the two alternatives was greater than 200 minutes, and we excluded one SP1 observation in which the (implicitly) suggested VTT was greater than 200 DKK per hour. Finally, we excluded respondents who had reported extreme values of travel time, waiting/changing time, or access/egress time, had not stated their age or sex, or had stated a personal income higher than their household income.

Other unrealistic answers concerning travel group size, housekeeping, and the trip cost for public transport users with season cards did not lead to exclusions of respondents.

The remaining sample consists of 6,106 respondents with a total of 47,249 SP1-observations. The statistics of background variables (sections 4.1- 4.3) concerns these respondents.

3.2 Additional cleaning for SP2

We made further exclusions for the analysis of SP2, based on SP2 choice variables or background information related to this experiment: First of all, dominant alternatives were identified as alternatives where all attributes are better than or equal to the corresponding attributes of the other alternative, with at least one being strictly better. All choices including dominant alternatives were excluded, as well as all observations for respondents who picked a dominated alternative.

Further, car drivers/passengers were excluded if the time spent walking to/from the car exceeded 60 minutes (12 respondents). A car driver with a parking search time of 310 minutes was excluded, as was a single observation with a very high congested driving time attribute for a respondent who should not have been presented with congestion in the experiment.

Public transport respondents were excluded if the access time or the egress time for the reference trip exceeded 60 minutes. Because of a design error, the headway attribute was missing for some alternatives (387 observations in the single-mode experiment, and 62 in the multiple-mode

experiment), such that the presentation to the respondent was "There is one bus/metro/train" instead of "There is one bus/metro/train every *x* minutes". These observations are excluded. Finally, for the multiple-mode experiment, all in-vehicle times in Part A had to be positive as both alternatives use both modes. However, in Part A there are 20 observations where at least one in-vehicle time is zero. In Parts B and C, at the most one of the in-vehicle times in a given choice should be zero, namely for the unused mode in the single-mode alternative. In each of Part B and C, there are 10 observations for which more than one in-vehicle time is zero. These observations are excluded.

The final samples used for estimation are summarised in Table 2 below.

Table 2: SP2 sample sizes

SP2 Experiment	# respondents	# choices
Car	1437	7888
Public transport – Single mode	1996	13474
Public transport – Multiple mode	790	6034

4 Data description

Because of the sampling procedure we do not expect the sample to be representative of the Danish population. To obtain a common national value of time, the individual time values found in the analysis will be aggregated by weighting respondents in the sample according to the representativeness of their socio-demographic characteristics and the performed trip. The weights are calculated by comparison with the National Transport Survey (TU data), which is representative of the Danish transport pattern.

We therefore focus in our data description on characteristics that are relevant for the representativeness of the sample, as well as those relevant for estimation and analysis.

Sections 4.1 and 4.2, deal with interview types and socio-demographic characteristics. As data for experiment 1 includes all respondents who participated in the following experiments, these two sections are common for all experiments. However, Section 4.3 concerns trip related variables, which vary between the experiments; this section is thus specific for experiment 1.

4.1 Transport modes and interview types

Of the remaining 6,106 respondents, 2,669 have car as main mode, 3,128 use public transport, and 309 are ferry passengers. The distribution on modes is described in detail in Table 3 below. Since the estimation of SP1 operates with seven mode segments (car driver, car passenger, bus, Metro, S-train, train and ferry), that are separately estimated, most statistics presented in this note use this aggregated mode segmentation.

Table 3: Number of observations by main mode

Car, driver	**2167**
Car, passenger	**502**
Bus	**1257**
City bus	665
S-bus	162
Express bus	39
Coach	363
Long distance bus	28
Metro	**248**
S-Train	**615**
Train	**1008**
Regional train	553
IC train	358
IC Lyn train	97
Ferry	**309**
Total	**6106**

There are very few metro trips left after data cleaning. Of the initial 7,579 interviews, 557 were completed with metro as transport mode, but only 313 of these have metro as the main mode, and only 248 of the latter remain after data cleaning.

Approximately 70% of the 6,106 interviews were carried out on the Internet, and 30% were face-to-face interviews.

Table 4: Interview type by main mode

Main mode	Share of Internet interviews
Car driver	63%
Car passenger	76%
Bus	77%
Metro	88%
S-train	83%
Train	82%
Ferry	0%
Sample total	70%

4.2 Respondent characteristics

In this section we focus mainly on socioeconomic variables that influence the weighting of respondents, i.e. age, gender, income, occupation and geography. For further details see TetraPlan (2005). We compare our sample with TU data from 2002 and 2003[5], which are representative for the travel pattern of the Danish population. Hence comparisons are not against the population as a whole, but against the population travelling with the seven SP1 modes. Note however, that the number of metro and ferry observations is very small in TU (43 and 20, respectively); we therefore do not expect these mode segments to be representative.

Figure 1 shows how respondents in different mode groups are distributed with respect to gender. In general, for the whole sample, the share of males is slightly lower than in TU (48% versus 53%), indicating that women may be more likely to participate in the survey, either because of sampling or because of a higher non-response rate among men. However, when looking at each mode separately, it is only among car drivers that men tend to be underrepresented. Among car passengers and S-train users, men are

[5] Only TU observations with main mode corresponding to the ones used in the current study, and with non-missing income information. Further, for the 2002 data, we have made a between-mode correction of the person weights such that metro observations have the same share of total weight as in 2003 (to correct for the fact that only a limited part of the metro system was available in 2002.)

slightly overrepresented, while the bus and train samples match the population almost exactly. Metro and ferry deviates considerably from TU, but because of the small sample sizes (for the TU sample as well as ours), we cannot know if this is in any way significant.

When comparing across modes, there are considerable differences. As may be expected, the majority of public transport users and car passengers are women, while car drivers and ferry passengers are more often men.

Figure 1: Gender distribution

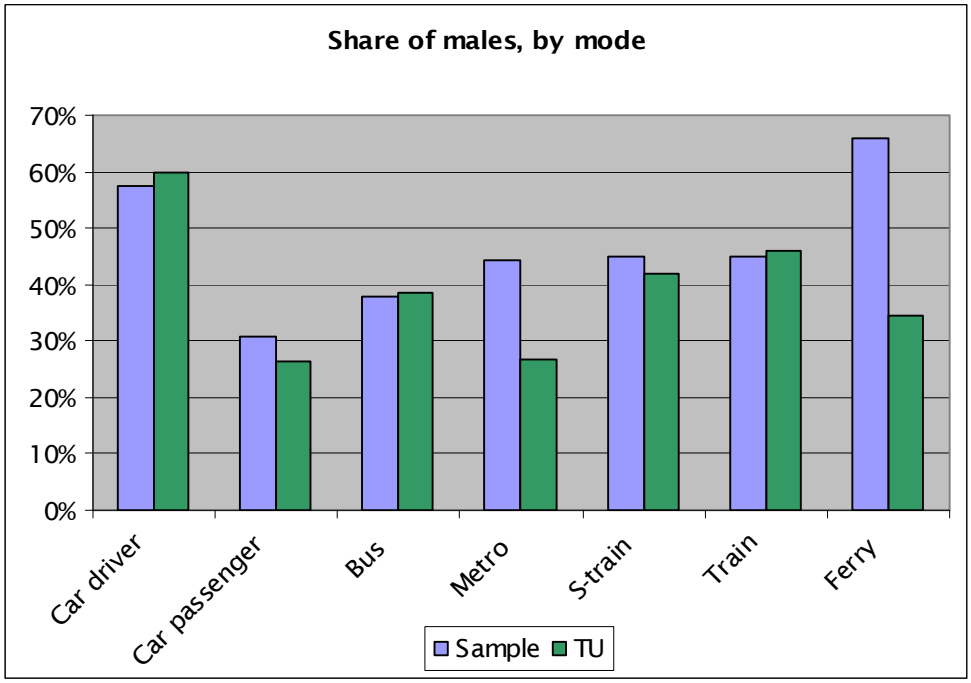


Figure 2 below shows the age distribution of our sample as a whole. In general, young people (aged 16-30) are overrepresented, older people (60+) are somewhat overrepresented, while the age group 30-60 is underrepresented. This is most likely due to the sampling procedure, as extra efforts have been made to guarantee enough trips with education as purpose.

Figure 2: Distribution of age

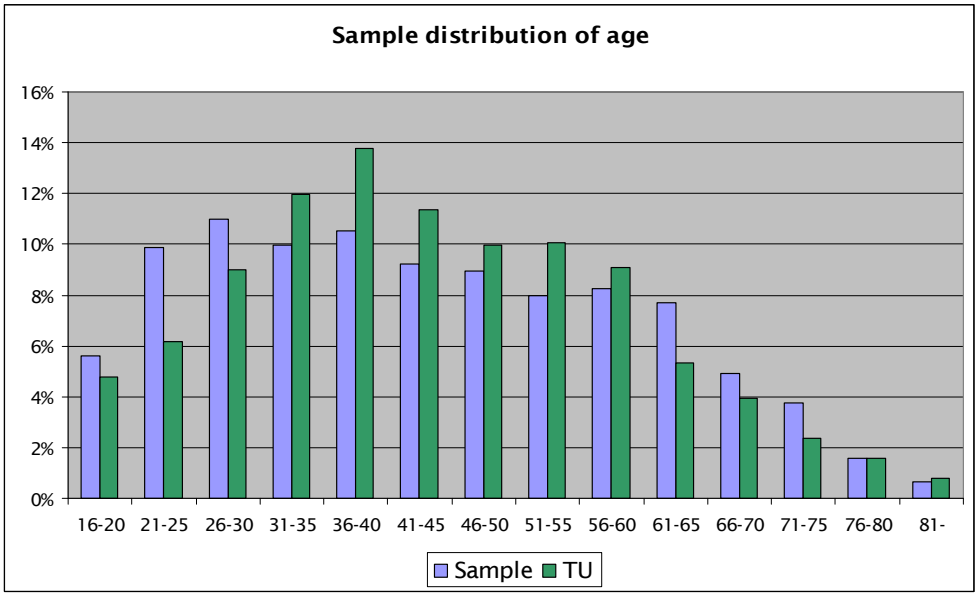


Figure 4 in the Appendix shows mode-specific age distributions. There are significant differences among the modes. In general, public transport modes have a relatively large share (34%-43%) of respondents aged 16-30 compared to car drivers (11%) and ferry (12%). Even though the same pattern is found in the TU data, young respondents are overrepresented in all public modes, which explains the overrepresentation in the overall sample.

Among car drivers and car passengers, the age group 60+ is highly overrepresented compared to TU, while for public modes (except train) it is slightly underrepresented. Hence the large share of older car drivers/passengers causes an overrepresentation of the 60+ group in the overall sample.

Again there are quite large deviations between our sample and TU for the metro and ferry segments. However, we can compare these two mode segments to the rest of our sample: Metro is very much like other public modes, while ferry passengers are a special case with more than 70% of the respondents being aged 30-60.

These differences between car and public transport are not unexpected: As a main cause we suggest income effects, as owning and using cars is quite costly in Denmark. Also, as already mentioned, we expect the extra effort made to obtain education purposed trips is likely to cause an overrepresentation of students, who are generally young and have lower income than the rest of the population. Due to income effects students are more likely

to choose public transport than other modes, and hence this increases the proportion of young people among public transport users.

This hypothesis is supported by Table 5, which gives the distribution of gross personal annual income for the sample, and the corresponding distribution for TU. Notice that respondents with missing income information are not included in the table.

Public transport modes have a much high share of low-income respondents (<100.000 DKK per year) than car drivers, but not that much higher than car passengers. In general, car drivers have a higher average income than car passengers and public transport users. Also, we see that our sample is not quite representative of the population, as lower income groups are systematically underrepresented and higher income groups overrepresented.

Again, it does not make much sense to compare our metro and ferry samples with TU. However, it seems obvious that our ferry sample deviates considerably from the other modes, with a much higher average income. This is in perfect agreement with the age distribution among ferry passengers (large share of respondents aged 30-60), and supports the theory of income effects, as travelling by fast ferry is faster, more comfortable and more expensive than using public transport[6].

[6] The fast ferries in the experiment were ferries connecting Jutland and Zealand. Travelling between Jutland and Zealand by bus or train implies using bridges/tunnels, which in many cases increases the trip length.

Table 5: Distribution of personal income by main mode (only respondents with known income)

		Personal gross income in 2003 (in 1000 DKK)										
Main mode		**<100**	**100-199**	**200-299**	**300-399**	**400-499**	**500-599**	**600-699**	**700-799**	**800-899**	**900-999**	**>1000**
Car driver	Sample	8.1%	21%	28%	21%	11%	5.1%	2.5%	1.5%	1.3%	0.5%	0.8%
	TU	6.5%	23%	40%	17%	7.3%	2.8%	1.5%	1.0%	0.2%	0.4%	1.0%
Car passenger	Sample	19%	25%	23%	20%	5.6%	4.8%	1.5%	0.4%	0.8%	0.4%	0.0%
	TU	26%	31%	32%	7.5%	2.6%	0.8%	0.4%	0.1%	0.0%	0.1%	0.1%
Bus	Sample	28%	25%	22%	12%	5.4%	3.0%	2.6%	0.8%	0.6%	0.2%	0.3%
	TU	33%	35%	23%	5.6%	2.5%	0.5%	0.1%	0.1%	0.0%	0.0%	0.2%
Metro	Sample	18%	18%	22%	19%	8.8%	7.5%	3.3%	1.7%	0.4%	0.0%	1.3%
	TU	27%	45%	22%	4.7%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%
S-train	Sample	19%	18%	25%	17%	12%	5.1%	1.7%	0.8%	0.8%	0.2%	0.8%
	TU	17%	27%	35%	14%	5.6%	0.5%	0.8%	0.2%	0.1%	0.1%	0.1%
Train	Sample	24%	19%	25%	15%	8.0%	4.2%	2.1%	0.9%	0.4%	0.2%	1.2%
	TU	30%	22%	26%	12%	6.1%	1.9%	0.9%	0.4%	0.1%	0.0%	0.0%
Ferry	Sample	4.6%	10%	20%	22%	15%	10%	5.9%	3.9%	0.7%	2.3%	4.9%
	TU	28%	12%	51%	0.0%	0.0%	8.5%	0.0%	0.0%	0.0%	0.0%	0.0%
All modes	Sample	17%	21%	25%	18%	9.0%	4.9%	2.5%	1.2%	0.8%	0.4%	0.9%
	TU	12%	25%	37%	15%	6.2%	2.3%	1.2%	0.8%	0.2%	0.3%	0.8%

Table 6: Occupation by main mode

		Occupation								
Main mode		**Wage earner**	**Self-employed**	**Assisting spouse**	**Apprentice**	**Student**	**Retired**	**Married without empl.**	**Other not employed**	**Unemployed**
Car driver	Sample	57%	5.4%	0.1%	0.9%	5.0%	26%	1.2%	1.1%	3.2%
	TU	71%	6.6%	0.3%	1.3%	4.0%	12%	0.6%	1.0%	2.9%
Car passenger	Sample	50%	3.2%	0.4%	1.0%	7.6%	29%	3.2%	2.2%	2.8%
	TU	53%	2.2%	0.3%	2.8%	16%	19%	0.8%	1.7%	4.3%
Bus	Sample	44%	1.5%	0.0%	1.8%	33%	13%	0.8%	0.7%	5.2%
	TU	38%	0.9%	0.0%	2.1%	29%	24%	0.4%	1.7%	3.7%
Metro	Sample	52%	3.6%	0.0%	2.4%	27%	8.5%	1.2%	0.0%	4.8%
	TU	37%	0.0%	0.0%	0.0%	44%	15%	0.0%	1.8%	2.0%
S-train	Sample	56%	4.2%	0.2%	1.0%	23%	10%	0.3%	0.5%	4.9%
	TU	61%	1.0%	0.0%	2.7%	15%	16%	0.0%	0.0%	4.4%
Train	Sample	52%	2.7%	0.0%	2.3%	29%	7.8%	0.5%	0.8%	4.9%
	TU	54%	1.1%	0.1%	1.1%	32%	7.5%	0.0%	1.9%	1.8%
Ferry	Sample	61%	17%	0.3%	1.0%	2.6%	15%	0.6%	0.3%	1.3%
	TU	35%	8.5%	0.0%	0.0%	24%	17%	0.0%	0.0%	15%
All modes	Sample	53%	4.4%	0.1%	1.4%	17%	18%	1.1%	0.9%	4.0%
	TU	66%	5.4%	0.3%	1.6%	8.1%	14%	0.6%	1.2%	3.2%

The occupational distribution of the sample is shown in Table 6. A general comparison shows that workers (wage-earners, self-employed, and assisting spouses) are underrepresented in our sample, with a slightly overrepresentation of retired and unemployed, and a heavy overrepresentation of students. We ascribe the large share of students to the sampling quota on education-purposed trips, and the remaining discrepancy between workers and non-workers to the fact that non-workers generally have more time to participate in surveys.

For wage earners and self-employed we know the weekly number of hours worked, and whether the working time is fixed, flexible or changing. The mean number of hours worked is 37 hours per week, which is very close to the average for the population[7]. Moreover, except for ferry, there is not much variation across transport modes. Ferry passengers have an average of 44 hours per week, reflecting partly the large share of self-employed (who works more hours), partly that the both wage-earners and self-employed work more than average.

Almost half of the workers in the sample have flexible work times, and only 13% have changing work hours. There are differences across modes: Among S-train, train and ferry passengers the share of workers with flexible work hours is somewhat higher (53%-62%), and for car passengers it is only 36%.

Work time flexibility is highly correlated with income (see Figure 3). The higher the income, the larger the share of workers with flexible work hours, and the lower the share of workers with changing work hours.

[7] We do not have details of working hours/flexibility in TU. The 37 hours is the population average from Statistics Denmark (see "Statistisk Årbog 2005", table 163)

Figure 3: Relation between flexibility of work time and income

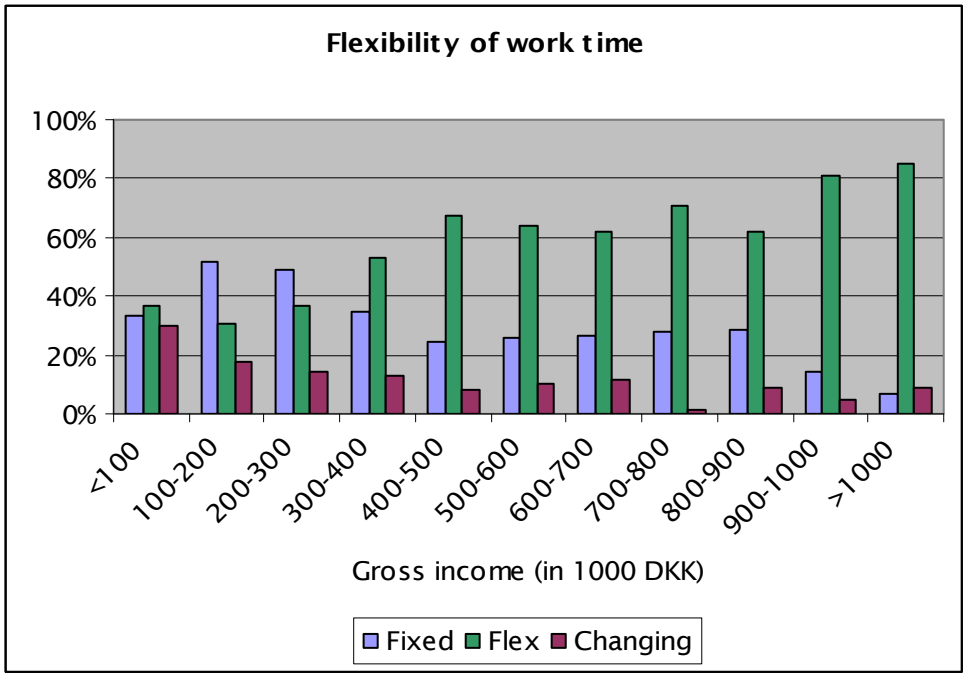


Table 7 below compares the geographical distribution of respondents to TU. Notice that TU is not representative with respect to geography, but instead with respect to degree of urbanisation. We therefore also compare our sample total to the geographical distribution of the entire population.

Compared to the entire population, both our sample and the TU contain many respondents from the Greater Copenhagen Area and very few from the small cities and rural areas. For our sample this is partly explained by the survey design: S-train is only available in the region around the Greater Copenhagen Area, and metro only in the centre of the capital, so to get enough respondents with these as main modes a relatively large part of respondents from the area was needed.

The high share of respondents from the Greater Copenhagen Area could be expected to cause a relatively low frequency of car ownership in the sample, since according to Statistics Denmark more than 70% of the inhabitants in the capital do not have a car at their disposal. But this is not the case. Only 30% of the respondents state that their household does not dispose of a car – the corresponding figure for the Danish population is 45%.[8]

[8] See Statistics Denmark, "Statistisk Årbog 2005", table 369

Table 7: Area of residence by main mode

Main mode		Area: Greater Copenhagen area	Area: City, more than 20,000 inhab.	Area: City, less than 5,000 inhab. /rural area
Car driver	Sample	19%	29%	51%
	TU	34%	26%	39%
Car passenger	Sample	18%	34%	48%
	TU	33%	31%	36%
Bus	Sample	33%	41%	26%
	TU	57%	28%	15%
Metro	Sample	99%	0.0%	1.2%
	TU	98%	0.0%	2.1%
S-train	Sample	90%	6.2%	3.6%
	TU	97%	1.5%	1.3%
Train	Sample	36%	39%	25%
	TU	57%	22%	21%
Ferry	Sample	33%	34%	33%
	TU	31%	27%	42%
All	Sample	36%	30%	34%
	TU	38%	26%	36%
Danish population * (2004)		20%	27%	53%

* Statistics Denmark, www.statistikbanken.dk, BEF4A

Another wealth measure is the share of home ownership in the sample, see table 6 below. On average, 62% of the respondents own their own home; this is very similar to the Danish population where 60% are home owners. There are great differences across transport modes, though. The lowest home owner shares are found for bus and metro, i.e. modes that are typically used in the Greater Copenhagen Area or in other large cities. This is to be expected, since housing is more expensive in these areas.

Table 8: Share of home ownership

Car, driver	78%
Car, passenger	76%
Bus	45%
Metro	36%
S-Train	51%
Train	50%
Ferry	76%
Sample total	62%
Danish population* (2004)	60%

* Statistics Denmark, "Statistisk Årbog 2005", table 249

Home ownership is obviously correlated with age and income. The share of home owners increases with age in the interval 20-60 years; with the steepest increase in the first half of the interval. After 60 years, the share of home ownership decreases. This decrease is steeper for public transport than car modes, for whom the decrease does not become significant until after 75 years.

Among the youngest respondents (aged 16-20), who are likely to live with their parents, the share of home ownership is very high (64%), suggesting that home ownership also depends very much on household type. Roughly speaking, there are about twice as many home owners among respondents living in couples with or without children as among singles. For public transport users, couples with children have significantly higher share of home ownership than couples without children. For car modes, the difference is much smaller.

4.3 Trip related variables

This section concerns variables related to the reference trip reported by the respondent. The weighting of trips according to TU data will be based on trip purpose and length. These variables are therefore the main focus of this section, but other trip characteristics are also described and compared to TU data.

Concerning purpose, there are four main types of trips:

- Commuting trips: between home and work.
- Education trips: between home and education.
- Leisure trips: visits, holiday travel, meetings, sports activities, entertainment etc.
- Maintenance trips: shopping, errands, dropping off people etc.

Table 9 shows the distribution of trip purpose for each main mode. In total, leisure and maintenance trips constitute 67% of all reported trips – leisure alone around 41%.

Table 9: Trip purpose

		Trip purpose			
Main mode		**Commuter**	**Education**	**Maintenance**	**Leisure**
Car driver	Sample	22%	8.1%	31%	39%
	TU	28%	2.4%	42%	27%
Car passenger	Sample	8.2%	0.6%	39%	52%
	TU	12%	3.1%	32%	53%
Bus	Sample	24%	24%	26%	26%
	TU	27%	15%	29%	29%
Metro	Sample	23%	12%	32%	34%
	TU	22%	29%	16%	33%
S-train	Sample	27%	12%	20%	41%
	TU	44%	7.4%	18%	30%
Train	Sample	23%	8.9%	14%	53%
	TU	43%	18%	8.8%	30%
Ferry	Sample	19%	1.3%	5.2%	74%
	TU	7.9%	4.5%	15.4%	72%
All	Sample	22%	11%	25%	42%
	TU	26%	3.8%	39%	32%

Bus modes have the lowest fraction of leisure trips of all modes, which could be explained by the low level of comfort compared to car and train.

11% of the trips are education trips; as would be expected there are very few education trips among ferry passenger observations, as few of them are students. There are also very few education trips among car passenger observations, which is perhaps less intuitive. However, the general picture for education trips is in line with expectations, with bus having relatively high shares of education trips compared to other modes.

Compared to TU data education trips are very overrepresented in our sample. If the sample was otherwise representative, we would see the other purposes equally sized down. However, this is not the case – our sample differs significantly from TU by the large share of leisure trips, which is much larger than the share of maintenance trips.

Another feature closely linked to the purpose distribution, is how often the reference trip is made. We expect commuter trips to be quite frequent, as most people travel to work 5 days a week. Leisure trips are expected to be somewhat less frequent than trips with other purposes.

The distribution of frequency of the reference trip is shown below, both by trip purpose (Table 10), and by mode (Table 11). From the former we see a distinct difference in trip frequency between commuter/education trips on the one side and maintenance/leisure trips on the other: Commuter and education trips are generally trips frequently made, with around half of the trips being made at least 4-5 times a week. Leisure and maintenance trips are on average very infrequent, as 80% of the leisure trips and 64% of the maintenance trips are made only once a month or less often.

This fact together with the sample purpose distribution causes a large share of the reference trips to be very infrequent. This odd frequency distribution is undesirable: The SP experiments are abstract and quite demanding, and we do not feel confident that respondents are able to value small time and cost changes for trips they make less than once a month.

Table 10: Reference trip frequency, by trip purpose

	Frequency of reference trip					
Purpose	Daily	4-5 times a week	1-2 times a week	Once a week	Once a month	Seldom
Commuter	27%	27%	12%	11%	11%	12%
Education	21%	27%	16%	11%	9.3%	15%
Maintenance	3.1%	4.4%	12%	16%	28%	36%
Leisure	0.95%	1.5%	4.9%	13%	32%	48%
All	9.4%	11%	9.4%	13%	24%	33%

Table 11 reveals that especially car passenger trips and ferry trips tend to be infrequent, but that the tendency applies to all modes.

Table 11: Reference trip frequency, by mode

	Frequency of reference trip					
Main mode	Daily	4-5 times a week	1-2 times a week	Once a week	Once a month	Seldom
Car, driver	12%	13%	11%	15%	23%	26%
Car, passenger	1.8%	3.6%	9.4%	14%	28%	43%
Bus	11%	14%	10%	14%	21%	30%
Metro	9.3%	5.6%	10%	15%	33%	26%
S-Train	12%	9.3%	8.9%	15%	22%	32%
Train	7.1%	11%	6.3%	9.8%	27%	39%
Ferry	0.0%	0.6%	2.3%	9.4%	16%	72%
All	9.4%	11%	9.4%	13%	24%	33%

Table 12 gives the distribution of trip length in the sample. The trip length is defined as the length of the entire reference trip, which may be a multi-ple-mode trip chain. Note that the car trips in our sample are trips using only the main mode, while the TU car trips may be part of a multiple-mode trip chain. This contributes to explain the main differences between our sample and TU; that short car trips are much underrepresented, while there

are relative many long car trips (more than 50 km). Regarding the public modes, our sample resembles TU.

Table 12: Trip length (in km)

		Distance *			
Main mode		**0-20 km**	**20-50 km**	**50-100 km**	**100+ km**
Car, driver	Sample	37%	34%	14%	14%
	TU	80%	15%	3.9%	1.7%
Car, passenger	Sample	52%	19%	18%	12%
	TU	73%	17%	6.2%	3.9%
Bus	Sample	74%	19%	4.5%	2.9%
	TU	84%	12%	1.7%	2.3%
Metro	Sample	95%	4.0%	0.81%	0.0%
	TU	100%	0.0%	0.0%	0.0%
S-Train	Sample	65%	31%	4.1%	0.33%
	TU	64%	30%	5.3%	0.36%
Train	Sample	12%	32%	20%	36%
	TU	18%	43%	19%	20%
All	Sample	48%	27%	12%	13%
	TU	78%	15%	4.4%	2.3%

* Not available for ferry

We do not observe the distance travelled in the main mode. Instead we look at the mean travel time in main mode, which is shown in Table 13. In general, our sample has longer trips than TU, especially for car modes and train, but also for bus. This suggests that short trips are indeed underrepresented. The variation over transport modes seems reasonable: Metro, S-train and bus have the lowest average travel times, and long-distance bus and IC trains have the highest. Except for the "short-time" modes, leisure trips generally have much longer travel time than other trips.

Table 13: Mean travel time in main mode (in minutes), by trip purpose

		Trip purpose				
Main mode		**Commuter**	**Education**	**Maintenance**	**Leisure**	**All**
Car driver	Sample	32	21	33	60	42
	TU	21	17	13	23	18
Car passenger	Sample	20	42	25	53	40
	TU	20	27	18	29	24
Bus	Sample	31	27	25	41	31
	TU	24	27	16	35	25
Metro	Sample	11	10	12	11	11
	TU	10	10	6.9	10	9.4
S-train	Sample	24	19	22	25	23
	TU	23	22	19	21	22
Train	Sample	56	68	66	93	78
	TU	41	35	41	65	47
Ferry	Sample	65	65	60	54	56
	TU	20	10	13	172	128
All	Sample	35	30	32	58	43
	TU	22	22	14	26	20

The price of the reference trip was assessed as follows:

- For car modes, the cost was calculated using a driving cost of 0.75 DKK/km. Respondents were asked if they found this estimate reasonable; otherwise the trip cost was based on their own estimate.

- Public transport users were first asked about their type of ticket. If this was a single ticket, or a reduced-price ticket valid for a number of journeys, they were asked about the price of a single one-way trip. If the ticket was a return ticket, the ticket price was divided by two. If respondents were holding a season card, they were asked about the price and coverage period of the card, and of the number of trips made with this period. The trip cost was the inferred from this information.

- Ferry passengers were simply asked the price of their ferry-ticket for a one-way trip. This was used as the reference trip cost.

In general, the trip cost is positively correlated with the travel time.

As a supplement to the price information respondents were asked who paid for their trips. Of car and public transport trips, 87% and 94%, respectively, were paid by the respondents own household; while for ferry the same goes for only 64% of the trips. This difference is partly caused by the high share of employer-paid trips among ferry trips. This share is 26%, while for car and public transport it is only 4%-5%.

It seems possible that a significant proportion of the ferry trips were in fact business trips, even though business trips were not intended to be included in the survey. Of the 309 ferry trips 64 were commuter/education trips, and 60 of these were paid by the employer. It is also interesting that only 76% of the employer-paid trips are commuter/education trips – the rest are leisure and maintenance trips. However this is not a special case for ferry: for car modes only 55% of the employer-paid trips are commuter/education trips, and for public transport it is 61%.

Another factor of interest is whether the respondents had to arrive at their destinations at a fixed time. Ferry passengers were not asked about this, but the information is available for all other transport modes. Of the 5,797 respondents in these modes, 34% had to arrive at a fixed time, 24% had some flexibility, and the remaining stated that the arrival time did not matter.

4.3.1 Variables specific to car modes

43% of the car drivers and 35% of the car passengers experienced congestion on their reference trip. This difference between drivers and passengers could be caused by their different socio-demographic characteristics (perhaps car pooling is more widely used in parts of the country where traffic is less congested). Another possibility is that drivers and passengers on similar trips perceive congestion differently, as passengers a) not necessarily to the same degree as drivers pay attention to the surroundings, and b) have the possibility to use the driving time to do other things, e.g. work or sleep.

The average share of congestion (in percent of total driving time) over all car trips is 9%. However, among those who experience congestion, the average share of congestion is 22% for car drivers and 23% for car passengers.

4.3.2 Variables specific to public transport.

Public transport users were not asked about congestion, but instead they had to state whether or not they experienced delay on their trip. On average 17% of the trips were delayed.

Table 14: Occurrence of delay in % of all public transport trips

	Share of delayed trips				
	Work	**Education**	**Maintenance**	**Leisure**	**All**
Main mode					
Bus	15%	19%	8%	11%	13%
Metro	14%	10%	11%	10%	11%
S-train	14%	19%	10%	9%	12%
Train	31%	36%	26%	24%	27%
All public transport	19%	22%	13%	16%	17%

As shown in Table 14 the extent of delay varies considerably with the modes and purposes. Bus, metro and S-train are very much alike, while train has rather high delay frequencies for all purposes. Commuter/education trips are on average more often delayed than maintenance trips, which again are more often delayed than leisure trips. The latter can be explained by congestion, as commuter/education trips often takes place in peak periods.

5 Concluding remarks

According to our sample, car passengers are usually women, while car drivers are more likely to be men.

Women are also more likely to be public transport users. While ferry passengers interviewed are mainly men.

Our sample also shows a higher representation of high income compared to the Danish population.

Compared to TU data, the sample also shows much shorter trips in time for Metro and s-train, while car drivers have longer trips measured in time.

As expected, because of the use of quotas in order to obtain enough data in each segment and the use of Internet based survey our sample is not fully representative of the Danish population.

As a consequence the individual value of travel time estimated from our sample must be aggregated by using a weighting procedure established in Phase 1.

6 References

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7 Appendix

Figure 4: Age distribution, by mode