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Summary:

Value of time, safety and environment in passenger transport – Time

In this report we account for the methods used to estimate values of time, reliability and comfort, and present our findings. The new values of travel time savings lie close to those found in the newest Swedish value of time study. They are also in the same order of magnitude as those found in the previous Norwegian value of time study in 1997, with the exception that the value of travel time savings for air travel has declined substantially. This can be explained by the fact that cheaper flight tickets have lead to the passenger segment in air travel becoming more mixed. Following international practice on the valuation of travel time variability, we have also derived reliability ratios – the value of a change in the standard deviation of travel time as a share of the value of travel time savings.

The purpose and content of the study

The Norwegian Value of Time Study was carried out in the period 2007-2010 and is a part of the more comprehensive Norwegian Valuation Study. The purpose is to produce unit prices of travel time savings and other components of time for different types of trips. The unit prices are to be used in cost benefit analyses of infrastructure investment and other measures in the transport sector.

The study covers long trips (more than 100 kilometres one way) by car, railway, air and bus, and short trips by car and public transport.[1] It also covers walking and cycling as a main mode (not access/egress trips), as well as ferry as part of a car trip, and speed boat. For both short and long motorised trips we estimate the value of on board time savings, the value of reducing trip time variability, and the value of time under congested conditions. For short public transport trips we also estimate the value of getting a seat. For ferry and speed boat trips we concentrate solely on onboard trip time and trip time variability. The walking and cycling study covers trip time, the number of stops at crossings, access to cycle lanes and separate rights of way for pedestrians, the level of upkeep of the walking and cycling facilities, and snow and ice clearance.

The value of time for business trips is not covered in this study.

[1] In a supplementary study that is covered in a separate report, the dividing line between long and short trips is set to 50 kilometers.

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Theory and method

The value of travel time savings can be measured on the basis of data on how travellers trade off time against cost. What we need is observations of the choice between combinations of travel time and cost in a variety of situations. Such data makes it possible to assess the relative importance of the two factors for the choice made. The value of time follows from that. Almost all studies of the value of time are now based on choices made in hypothetical choice experiments (stated preference), since this makes it possible to control the time and cost variables and addresses issues such as self selection and other problems involved in revealed preferences.

The choice experiments in the Norwegian Value of Time Study are carried out by a self-administered questionnaire on the internet. Members of an Internet panel were asked to take part in the study. To take part, you would have to be 18 years or older. 47 000 persons were contacted, of which 9280 answered. The response rate after two reminders was 20 percent. The main study took place between June 11th and July 2nd 2009.

Special care was taken to recruit enough speed boat and ferry travellers. If a respondent reported to have made one or more trips by ferry or speed boat, one of these trips was automatically chosen as the point of departure for the further questions (a reference trip), regardless of the number of other trips she reported. Supplementary recruitment of respondents directly on the boat or at the airport was carried out to increase the sample size. The sample for long speed boat trips was also increased by the inclusion of trips from the new survey in the spring of 2010 (see Samstad et al 2010).

The sample is not wholly representative for the travelling population. Comparison with the National Travel Survey of 2005 shows that young people (18-24 years) are underrepresented, and high income groups are overrepresented in the Internet panel. The distribution of trip lengths and trip purposes by mode differs in the two studies. The answers received were checked according to pre-set standards, after which 8744 sets of responses were retained.

The structure of the questionnaire in the Value of Time Study is as follows:

1. Introductory questions to collect data on socio-economic background and demographic characteristics of respondents,
2. Questions about the reference trip, to collect data on this trip,
3. Choice experiments to collect data on the respondents' trade-offs between cost and other aspects of the trip,
4. To conclude, control questions and collection of supplementary data on the respondent.

The data on socio-economic and demographic characteristics of the respondents are used to chart systematic variations (observed heterogeneity) in the value of time estimates.

To increase the realism of the survey, the (designated or chosen) reference trip reported by the respondent was used as a point of departure for nearly all subsequent choice experiments. Data on the attributes of the reference trip was used to calibrate the size of the attributes in the hypothetical alternatives to the reference alternative.

For those who have a motorised trip as their reference trip, there are two types of choice experiments. To study the mean value of time and the distribution of the value of time, we use a design with only two attributes, time and cost. The design is the same as that used in the Danish and Swedish value of time studies, and its key feature is that it admits of utility functions that do not conform to ordinary consumer theory, but exhibit loss aversion (Kahneman and Tversky 1979, Tversky and Kahneman 1991). Loss aversion means that the utility function depends on the consumer's existing wealth in such a way that whatever possession he has to concede is more valuable to him than if he would have to buy the same thing. The respondent gets nine games (choice situations) to decide on, plus a contingent valuation question in case her willingness to pay has not been sufficiently delimited by the nine games.

The other type of choice experiment for motorised trips has three attributes. These choice experiments are used to estimate the value of reliability, the value of getting a seat on local public transport trips, and the value of time when driving in congested conditions. Some of the respondents get two different experiments to assess the value of reliability. Others get either a choice experiment about the value of time in congested conditions or an experiment about the value of getting a seat on the bus, and then an experiment to sort out to what extent the value of time depends on characteristics of the transport mode and to what extent it depends on characteristics of the person.

A third type of design is used to estimate the value of time for cyclists and pedestrians and the value of improving the conditions for walkers and cyclists.

To analyse the two-attribute choice experiments and to assess the probability distribution of mixed logit parameters, we use non-parametric and semi-parametric methods (Fosgerau 2006, 2007). In this way we avoid making to strong assumptions in the estimation of mean value of time and the distribution of the value of time. Simple multinomial logit models are also used in parts of the study. Biogeme (Bierlaire 2003) was used to estimate the different models. The OX software (Doornik 2009) was used to estimate non-parametric regressions and for simulations.

For the value of access/egress time and transfers, we decided after a literature review to use results from the Swedish Value of Time Study.

Results

The value of travel time savings, short motorised trips

Table 1: In-vehicle values of time (2009 NOK/hour) for short trips by mode and trip purpose.

	Car driver	Public transport	Ferry	Speed boat
Trips to and from work	90	60		
Other private trips	77	46		
All private trips*	80	51	*126*	82
Business trips	380	380	380	380
All trips*	88	60		

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*Aggregated using shares from the Norwegian Travel Survey 2005. For ferries and speed boat, the sample sizes in the travel survey are too small to allow disaggregated values.

Table 2: Recommended weights for waiting time, access and egress time, and transfers. Short public transport trips.*

	Short public transport trips
Weight factor for waiting time 0 - 5 min	2,30
Weight factor for additional waiting time 6 – 15 min	1,88
Weight factor for additional waiting time 16 – 30 min	0,92
Weight factor for additional waiting time 31 – 60 min	0,56
Weight factor for additional waiting time over 60 min	0,28
Weight factor for access/egress time	1,0
Fixed cost per transfer	2 - 10 min

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*Defined as half of headway at the start of a scheduled trip and as actual waiting time by transfers.

The value of travel time savings, long motorised trips

Table 3: In-vehicle values of time (2009 NOK/hour) for long trips by mode and trip purpose.

	Car driver	Railway	Bus	Air	Speed boat
Trips to and from work	200	156	103	288	
Other private trips	146	92	73	180	
All private trips*	150	98	74	204	138
Business trips	380	380	380	445	380
All trips*	181	146	120	305	

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* Aggregated using shares from the Norwegian Travel Survey 2005 for car, rail and bus; for air trips using the Air Travel Survey 2007, with adjustments using Air Travel Survey 2009.

Table 4: Recommended weights for waiting time, access and egress time, and transfers. Long public transport trips.*

	Bus	Railway	Air	Ferry	Speed boat
Weight factor for waiting time 0 - 30 min	1,04	1,04	2,00	2,00	1,04
Weight for additional waiting time 31 – 240 min	0,54	0,54	1,00	1,00	0,54
Weight for additional waiting time over 240 min	0,40	0,40	0,80	0,80	0,40
Weight factor for access/egress time	1,36	1,36	1,36	1,36	1,36
Fixed cost per transfer	10 min	10 min		10 min	10 min

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*Defined as half of headway at the start of a scheduled trip and as actual waiting time by transfers.

Walking and cycling

Table 5: Values of time (2009 NOK/hour) for walking and cycling

	Walking	Cycling
All trips	146	130

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Weight factors for driving in heavily congested conditions

Table 6: Weights for driving in heavily congested conditions

	Short car trips	Long car trips
Weights	3,5	3,0

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Travel time variability

The weights in the table are to be used in the following way: We assume that information on travel time variability as measured by the standard deviation is available as input to the cost-benefit analysis. One unit's reduction of the standard deviation is to be valued by the in-vehicle value of time multiplied by the weight factors given in the table.

Table 7: Preliminary valuation of travel time variability by mode

Mode	Weight factor
Short trips	
Car	0,42
Public transport	0,69
Speed boat	1,02
Ferry	0,42
Long trips	
Car	0,25
Bus	0,42
Railway	0,54
Air	0,20
Speed boat*	0,55

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Comfort factors

A distinction must be made between, on the one hand, quality and comfort differences between trips within the same mode, and, on the other hand, the average quality and comfort difference between two modes. Regarding the first kind of differences, our project has produced unit values of getting a seat on the (public transport) trip.

Table 8: The value of having a seat on short public transport trips if the base case was having to stand during the whole trip. NOK/trip.

	Short public transport trips
Seat on a quarter of the trip	5,0
Seat on half of the trip	14,3
Seat on most of the trip	24,0
Seat on the whole trip	27,5

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The *average* comfort and quality differences between modes may be derived from our analysis of factors that influence the value of time. We have succeeded in differentiating between factors due to the traveller and factors due to the mode. At the moment, we have not concluded on how this knowledge is to be used in economic analyses.