Summary

The Norwegian value of time study on freight transport 2018

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The value of transport time savings (VTTS) varies significantly between commodities, something which needs to be taken into account when estimating the economic benefits of transport measures that affect freight transport. We have conducted a national valuation study with a comprehensive data collection among firms within all commodity groups. The results show that VTTS is highest for fresh fish, thermo goods and high value goods and lowest for timber. The values are higher than the implicit VTTS in the national freight model (NGM), which is used for predicting transport flows. This implies that using the results in combination with NGM is not straightforward.

The purpose of this study is to estimate the benefits of transport improvements that relate to the transported goods. The survey covers shippers and some receivers of goods.

Survey design

The study is based on *stated preferences*, where respondents make hypothetical choices between alternatives with different charateristics in so-called choice experiments. Figure S 1 shows an example of a choice task in the first choice experiment, where the two alternatives have different transport time and cost. The survey also contains two different choice experiments that also include uncertainty of travel time and shipment/delivery time.

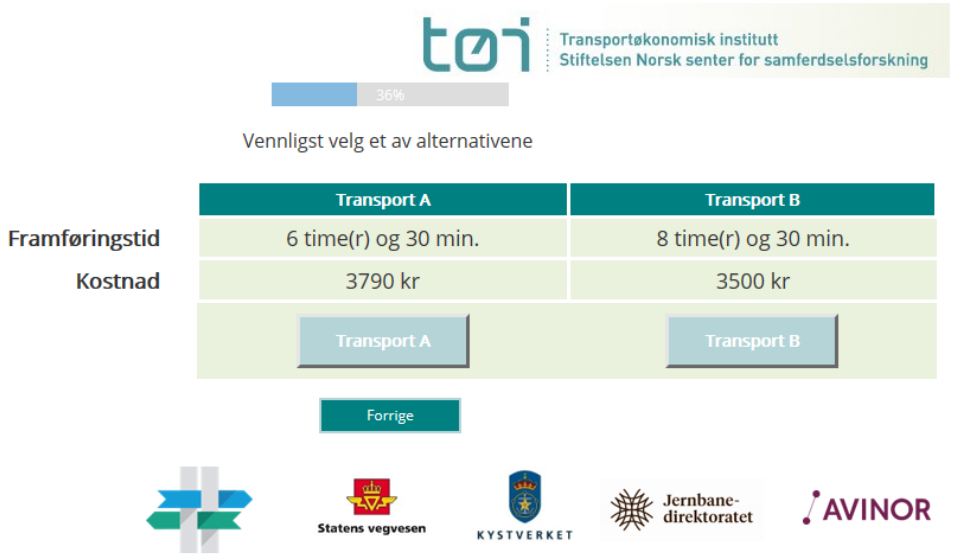

Figure S 1: Example of a choice task in choice experiment SP1.

The choice tasks are designed such that they have as relevant and realistic alternatives as possible, while at the same time reveal the preferences of each firm. The characteristics of

the alternatives are based on actual transport time and cost of one of the most recent or typical transports of the firm. The questionnaire is designed to collect the necessary information about this transport. It also contains questions about the transport use of the firm and opinions on transport policy.

Data collection

Condiderable effort has been put into collecting data that covers all Norwegian industries and makes it possible to estimate unit values for different commodity groups. We first conducted a survey among respondents recruited from relevant sectors in the the Norwegian Central Register of Establishments and Enterprises (CRE) ('main survey'). At the end of the project, we also conducted a separate survey among firms that have access to their own harbour in order to get more data on sea freight. This sample also contains some firms that receive but do not ship goods.

Firms from CRE were segmented into 14 industries based on the commodity groups in the national freight model (NGM). We expected small samples in some critical industries. In these industries, more resources were put into obtaining correct contact information and contacting firms to make sure that they answered the survey. The survey itself was carried out using email invitations with links to an online questionnaire.

Figure S 2 shows the number of responses for different commodity groups when the additional survey on sea freight is not included. This resulted in more responses particularly for dry bulk, but also some of the other segments with small samples.

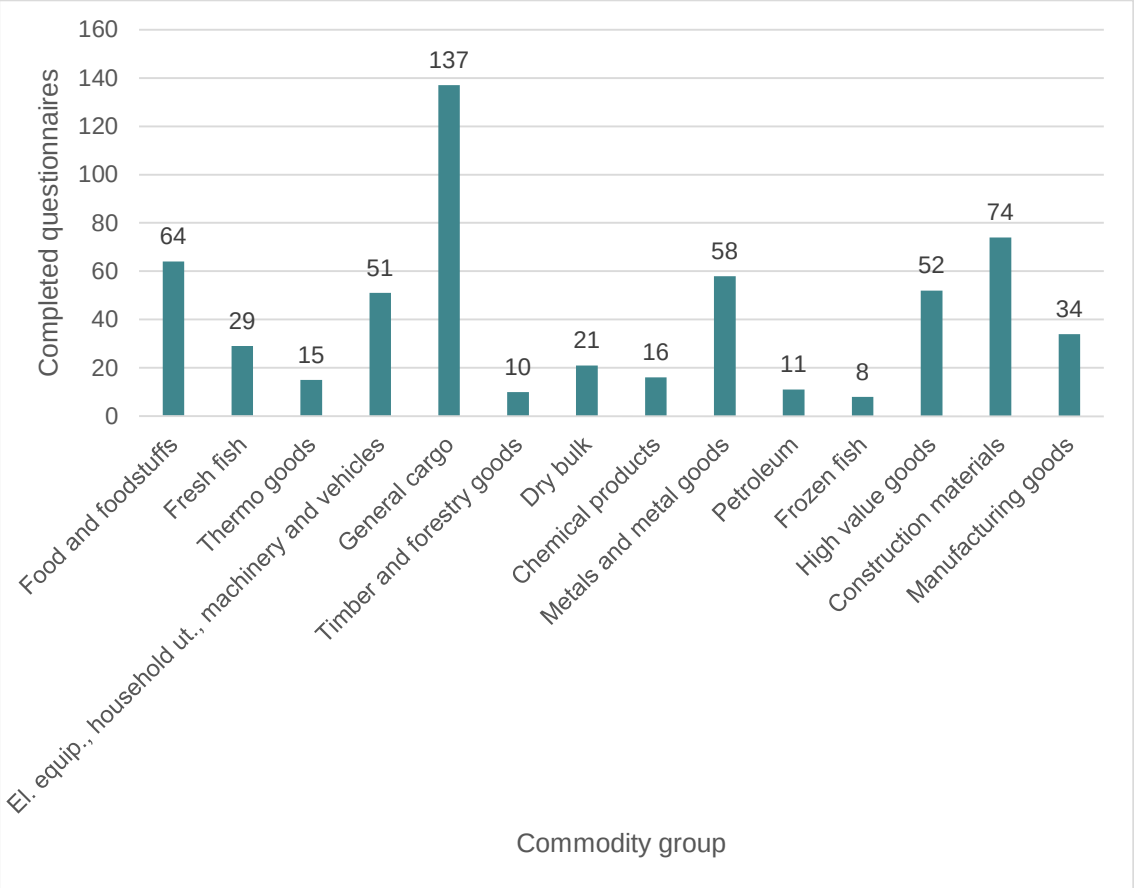

Figure S 2: The number of responses in different commodity groups.

In order to avoid dropouts, the questionnaire was designed such that it would be interesting and not too demanding to fill out. Some respondents nevertheless dropped out in the beginning of the questionnaire, either because they were not in the target group or did not complete the questions about the reference transport. Among those who proceeded to the choice experiments, almost everyone completed the questionnaire. This suggests that respondents found these questions meaningful and interesting.

Analysis

Descriptive analysis of the data shows large variation with respect to shipment size, cost and transport time, and the relationship between these characteristics. This has to be accounted for in analysis. It might also imply that the experiment has not worked equally well for all transports.

Most firms seem to have made trade-offs between cost and transport time in the first choice experiment. However, about 10 percent in the main survey always chose the cheapest alternative, and 11 percent always chose the fastest. This could reflect both extreme preferences and shortcomings in the design. In the two other choice experiments, respondents seem to have put less weight on uncertainty of travel time (reliability) than expected. The reasons for this should be investigated in a follow-up project.

We have analyzed the data from the first choice experiment using multinomial logit models where we model the value of transport time savings (VTTS) directly and esetimate the effects on VTTS of various explanatory variables, a model in the so-called 'willingness-to pay space'. We have not include unobserved heterogeneity in the form of a parametric statistical distribution of VTTS ('mixed logit'), as the results of such models were not robust.

We use the commodity flow survey to construct weights that are used in the simulation of representative VTTS for each commodity group. We weight with respect to shipment size, something which has a large effect on the VTTS measured in NOK per tonne-hour. Finally, we calculate a weigted average across all commodity groups. This average VTTS is based on tonne-kilometers from the national freight model (NGM).

Results and application

The simulated VTTS values based on the first choice experiment show large differences between commodity groups, as shown in Table S 1. VTTS is highest for fresh fish and relatively valuable commodities, and lowest for timber.

Based on these values, one can also calculate an average VTTS for all freight transport in Norway. This is 13 NOK per tonne-hour. Using this will however give misleading estimates of the eocnomic benefits of transport measures that affect different geographic areas or markets. We there recommend always using commodity-specific values unless the benefits related to freight constitute a very small share of total benefits. We do not recommend using different values for different modes of transport, as the mode in itself should not affect valuation.

Table S 1: Recommended values of transport time savings (VTTS). NOK per tonne-hour (2018).

Commodity group	Recommended VTTS
Fresh fish	193,6
Thermo goods	110,2
High value goods	106,1
Electrical equipment, household utensils, machinery and vehicles	74,2
Food and foodstuffs	32,2
General cargo	19,5
Frozen fish	19,4
Construction materials	14,0
Metals and metal goods	13,6
Petroleum	7,8
Dry bulk	4,8
Manufacturing goods	4,7
Chemical products	4,5
Timber and forestry goods	2,0

The results for value of reliability shows that respondents value a unit reduction in the standard deviation of transport time equivalent to a 0.23 units reduction in transport time. This reliability ratio (RR) is low compared to what one would expect based on theory and also lower than in earlier evidence from Norway, where the ration was larger than one. We therefore do not recommend basing the RR on our results alone. Instead, we recommend a preliminary RR equal to 0.8 based on a joint consideration of our results and existing evidence. Our results do not indicate any differences in the RR between commodity groups. The RR applies to door-to-door transport time.

I cost-benefit analysis of railway projects, it is common to measure reliability in terms of delay hours. If this is the choisen measure, we recommend valuing train delays by a factor of three times VTTS, also considering our results and existing evidence jointly. This is somewhat lower than in the results of Halse and Killi (2012). Given the relatively high VTTS, it still implies a considerable value of reliability.

We do not recommend using our results as input data to the national freight model (NGM) in its present form. This would result in a modal split which is not consistent with current market shares. The reason is that degredation costs in NGM partly are used as calibration parameters. If freight flows are predicted using NGM, this should be done using the current parameters. Then, one could calculate the user benefits by multiplying (1) the relative change in user benefits basd on NGM and (2) total logistics costs in the reference scenario based on our recommended VTTS. If freight flows are considered constant, our values can be applied directly.

In the longer run, we recommend developing NGM such that the model includes a constant term. When calibrating the model, one could then adjust the constant term and not behavioural parameters. In that case, VTTS from other sources can be used in the model.