ABSTRACT

Value of Travel Time Savings (VTTS) is probably the most important benefit in transportation investment projects. Nevertheless, knowledge about VTTS for cyclists is sparse. In a time of change to a more climate-friendly, urban transport system more knowledge of the topic is highly demanded. By utilizing a mixed logit model, this study estimate that the average VTTS for a Norwegian cyclist is higher than previously measured. Applying the average VTTS-value in national cost benefit analysis would make time-saving infrastructure and facilities for cyclists more profitable. By parameterizing the coefficients for time and cost, the study also find that *income* and variables related to *reasons to cycle* have large impacts on individual VTTS for cyclists.

PREFACE

This study is a master thesis in MSc in Economics at the Norwegian University of Science and Technology (NTNU), in cooperation with The Institute of Transport Economics (TØI), and with additional finance from the Norwegian Public Roads Administration (NPRA).

First and foremost I will like to thank my main supervisor Associate Professor Farideh Ramjerdi, researchers at TØI, and my co-supervisor Professor Hans Bonesrønning at Department of Economics at NTNU, for their excellent guidance on this master thesis. I am also grateful to researchers Stefan Flügel and Vegard Østli at TØI for helpful comments and discussion. I will also thank Harald Aas, Aslak Fyhri, Ulla Nørgaard Oulie, Askill Harkjerr Halse and other researchers and employees at TØI for useful discussions, provision of data material and access to the TØI library.

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Johannes Raustøl

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GLOSSARY

ASC	Alternative Specific Constant
CBA	Cost Benefit Analysis
MLE	Maximum Likelihood Estimators
MLF	Maximum Likelihood Function
MRS	Marginal Rate of Substitution
MNL	Multinomial Logit
MMNL	Mixed Multinomial Logit or simply Mixed Logit
NVTS	Norwegian Value of Time Study (2010)
PT	Public Transport
RP	Revealed Preference
SP	Stated Preference
VOT	Value of Time
VTC	Value of Time as a Commodity
VTR	Value of Time as a Resource
VTTS	Value of Travel Time Savings
WTA	Willingness to Accept
WTP	Willingness to Pay

1 INTRODUCTION

1.1 BACKGROUND

Cycling is a sustainable form of travel with positive external effects for the traveller and the society, such as health benefits and reduced car traffic (Börjesson and Eliasson**,** 2012; Sælensminde, 2002).[1] Norwegian policymakers have steadily acknowledged the importance of cycling as a transport mode. In the recent Norwegian Transport Investment Plan 2014 – 2023, presented in April 2013, it is a goal to increase the share of cyclists from today's 4 percent to 8 percent within the period (St. Meld. Nr. 26, 2013:19). The plan also submits another goal that future increase in urban travel demand should be taken with non-car alternatives (St. Meld. Nr. 26, 2013:81). This leaves no doubt that cycling will play an important part in Norwegian transportation and urban planning in the years to come.

To accommodate the goals above, cycle-friendly infrastructure and facilities will play an important role. Because infrastructure investments are capital intensive, new investments must be based on thorough cost benefit analysis (CBA) to make sure that limited resources are used as efficient as possible. Value of Travel Time Savings (VTTS) is probably the most central element in the evaluation of benefits and investments in transport infrastructure, as well as pricing of transport facilities (Ramjerdi, 1993:1), and according to Börjesson and Eliasson **(**2012:674) VTTS accounts for as much as 90% of the benefits in the Swedish transport investment plan, running from 2010-2021. Börjesson and Eliasson (2012:674) also calls for more research on the topic since "only few previous studies devoted to cyclists' value of time" have been carried out. In Norway, literature on VTTS for cyclists is limited, and more knowledge is highly demanded by researchers and policy makers.

Recent studies suggest that conventional knowledge about VTTS is not sufficient for developing policies for cycling (Heinen, van Wee and Maat, 2010:60). Given that very few previous Norwegian studies have analysed the VTTS for cyclists, it is timely to rectify the deficiency. The study seeks to ask: What is the VTTS of an average Norwegian cyclist, and which variables are important to explain variation in VTTS among cyclists?

[1] Sælensminde (2002) concludes that investments in infrastructure for cyclists have very high socioeconomic benefits, and states that such investments are often more socioeconomic profitable than building roads for motor transportation.

1.2 MAIN CONTRIBUTIONS

This thesis provides credible, average VTTS-estimates for Norwegian cyclists by utilizing the mixed logit model (MMNL) (McFadden and Train, 2010). This study find that estimating the VTTS with an MMNL-model increases the goodness of fit substantially compared to a multinomial logit model (MNL). The study also estimates an average VTTS of 162 NOK/hr for Norwegian cyclists. This value is higher than earlier Norwegian and Swedish studies (Stangeby, 1993; Ramjerdi, Flügel, Samstad and Killi, 2010b; Börjesson and Eliasson, 2012; Börjesson, 2009), but similar to the recent Norwegian VTTS-study by Flügel, Ramjerdi, Veisten, Killi and Elvik (2013), in press. This suggests that Norwegian cyclists actually have a higher average VTTS than previously thought.

By parameterizing the mixed logit model the study investigate the variation in VTTS for Norwegian cyclists. The study estimate VTTS-values for the total sample, as well as for rural, urban, male and female segments. This leads me to the conclusion that values connected to *income* and *reason to cycle* explains large variations in VTTS. Variables such as *exercise* and *environment* can reduce the VTTS of group of cyclists by up to 100 NOK/hr. As expected, the study finds that the marginal utility of money decreases in income, as suggested by theory and similar to other studies (Börjesson and Eliasson, 2012; Börjesson, 2009).

The study also finds that the average VTTS is slightly higher for males than females. The average VTTS is much higher for the rural sample than for the urban, which could be due to a higher average income in the rural sample.

1.3 INTRODUCTORY CLARIFICATIONS

This thesis estimates VTTS of *current* cyclists and investigates variables that affect their VTTS. In line with other VTTS-studies this thesis do not investigate issues of propensity to cycle for *new* cyclists, and assumes *new* cyclists to be equal to *current* cyclists, which is a customary approximation in the literature (Börjesson and Eliasson, 2012:675).[2]

[2] *New* cyclists are defined as travellers that normally do not cycle, but would be willing to cycle if new infrastructure were provided. *Current* cyclists are travellers that already cycle, given the infrastructure at hand (Börjesson and Eliasson, 2012:675). In addition there are people that would never cycle, even if new infrastructure were provided. Optimally estimates on VTTS for cyclists should be based on all travelers. But this is very challenging as there is currently no way to indentify the new cyclists (Börjesson and Eliasson, 2012:675). Börjesson and Eliasson (2012:675) states that "it is a customary approximation in practical CBA to ignore this complication (of not including *new* cyclists), and use the same value of time for both *new* and *existing* travellers on the mode that is improved", but calculate the average VTTS for cyclists based on current cyclists only. This means that the VTTS-estimates throughout this thesis are in reality "average" values of *current* cyclists. This assumption can obviously be problematic since new cyclists might have other characteristics and preferences,

This thesis is based on a stated preference (SP) mode choice experiment (see Figure 5:2). Ideally SP-studies apply realistic, hypothetical alternatives to respondents to infer their preferences in their mode choices, instead of actual observations about their choices, which are referred to revealed preference (RP). This makes SP-design the most common, experimental design in VTTS-studies (Ramjerdi et al., 2010b).[3] The SP experimental design used in this study relies on two attributes for cycle and two attributes for the alternative mode,[4] which can be seen in the experiment in Figure 5:2: Each cyclist makes a choice between cycle or his/her alternative mode (either car or public transport), based on time and cost for the alternative mode, and time and cycle path for cycle. A cost-coefficient is strictly necessary in order to calculate the VTTS, and since there is no monetary cost associated with cycle, the study include an alternative mode, that is associated with a monetary cost, in the experiment. The alternative modes are indentified by asking the cyclist which alternative mode he/she would prefer for the reference trip in case cycle was not available.[5] Utilizing the discrete choice framework by Train (2009), Ben-Akiva, Bierlaire, Bolduc and Walker (2010), and Ben-Akiva and Lerman (1987), it is possible to identify and estimate the VTTS for cyclists.

The study assumes that time saved or time lost in traffic is valued equally by any traveller. This is a normal assumption which implies that willingness to accept (WTA) and willingness to pay (WTP) are the same, i.e., the size of VTTS (Small, 2012:9).[6]

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than current cyclists, and this self-selection of *current* cyclists will lead to errors in the VTTS. Unfortunately, it is currently no way to identify the new travelers, as previously mentioned, and thus one has to accept that there might be certain biases in such VTTS-estimates.

[3] Over the past 20 years SP has become the most popular experimental design in VTTS-studies, and Ramjerdi et al., (2010b: ii) states that: “Almost all studies of value of time is now based on SP experiments since this makes it possible to control for the time and cost variables and addresses issues such as self-selection and other problems involved in RP-studies”. Other advantages with SP is the possibility to be able to construct alternatives with a larger set of attribute mixes, create non-existing alternative, increase the number of responses and pre-specify attributes (Hensher, 2007; Ben-Akiva, 2010:4:15). But the design also has its disadvantages. Louviere et al. (2000) emphasize that there might be challenges in capturing the main effects in an SP-study, because a lot of other co-interactions tend to interfere the choice experiment. Ben-Akiva (2010) states that since SP-experiments are hypothetical, this might produce a bias because cyclists may actually not reveal their true preferences. This might happen because alternatives are generated instead of reflecting actual events, which may seem less realistic and confuse the respondent. Secondly, preferences that are valuable for the individual might not be present in the experiment. And thirdly, cyclists may choose the political “correct” answer, though this answer does not reflect their true preference.

[4] A trip is defined as a “transfer between two locations to accomplish a specific mission” (NVTS 2010, appendix 1:93). One trip to the grocery store and one back, or to the kindergarten and then to work, are two examples that both will count as two trips.

[5] The reference trip is reported by the respondent in the beginning of the survey, and identifies whether the respondent is a cyclists or not, as well as other characteristics of the trip.

[6] WTP and WTA are measures that could differ in case of prospect theory (Tversky and Kahneman, 1991). Although the theory has been applied in VTTS-studies (Borger and Fosgerau, 2008; Hess, Bierlaire and Polak,

The Institute of Transport Economics (TØI) provided the data material, and the data material from 2009 and 2010 was merged to get a larger sample. The 2009-data have previously been used in the Norwegian Value of Time Study (NVTS), published by Ramjerdi et al. (2010a and 2010b). Regarding cyclists, the NVTS provides an average, standard logit, VTTS-estimate, as well as values on snow-removal, number of stops, cycle path access and general maintenance of these. Earlier Norwegian value of time (VOT) studies has been carried out, but this thesis only focus on the Norwegian value of time study from 2010 throughout this thesis, which this thesis refers to as the NVTS.

Foreign currency (non-NOK) VOT-values presented in the thesis are converted into NOK, using the average exchange rate of 2012 for the respective currency.[7]

All models were estimated in Biogeme 2.0. (Bierlaire, 2009) with 500 or 700 Halton draws.[8] The software SPSS was used as the data analysis tool. For some models, when adequate, the study only present overall statistical measures such as likelihood values. In such cases the full models can be found in Appendix I. All models have Biogeme report files that can be found in Appendix IV. Appendix II provides a description of coefficients, Appendix III shows some examples of VTTS-calculations and finally Appendix IV presents relevant parts of the internet survey.

Chapter 2 presents the theoretical framework, Chapter 3 is a literature review, Chapter 4 presents the discrete choice method and mixed logit model, whereas Chapter 5 explains the survey. Chapter 6 presents the data material with tables containing descriptive statistics and frequencies, Chapter 7 contains analysis and results, and finally Chapter 8 presents the main findings, conclusion and recommendation.

2008), prospect theory is not applicable for cycle because there are no transaction cost associated with this mode, which makes such an analysis inappropriate in this case.

[7] This counts for Euros and Swedish Kroners only, which have the exchange rates of: 1 Euro is 7.49 NOK, 1 SEK is 0.859 NOK according to Norges Bank (2013).

[8] Biogeme 2.0. is an open source freeware, designed for estimation of discrete choice models.

2 THEORETICAL FRAMEWORK

Becker's paper "A theory of allocation of time" form 1965 is one of the first to develop a general framework for the treatment of value of time in welfare economics. Later, the two papers by Johnson (1966) and Oort (1969) contributed to the discussion on VTTS. The basic assumption in the theoretical literature is that travellers would rather like to spend time at work or as leisure, rather than travelling, which means that they are willing to pay to reduce travel time for a given trip. To exaggerate one can say that travel time saving becomes a choice between a fast expensive mode and a cheap slow one. However, this straight comparison is inadequate because choice of travel mode also depends on other variables, and the simple observation above would only provide bounds on VTTS (Jara-Díaz, 2000). To account for this DeSerpa (1971) designed a theoretical framework that relates time and goods in a more explicit way.

2.1 THEORY ON VALUE OF TRAVEL TIME SAVINGS

DeSerpa (1971) formulated VTTS as a maximization of individual utility based on three restrictions:

$$Max\ U = U(X_1,\ldots,X_n,T_1,\ldots,T_n) \tag{2.1}$$

subject to

$$\sum_{i=1}^{n} P_i X_i = I \tag{2.2}$$

$$\sum_{i=1}^{n} T_i = T^0 \tag{2.3}$$

$$T > a_i X_i \tag{2.4}$$

P_i is unit prices, X_i are commodities, I is income, T^0 is total time, T_i is time allocated to consumption of good i and parameter a_i is consumption technology. The utility function holds the normal assumptions of positive, decreasing marginal utility in time and goods ($U_i' > 0, U_{ii}'' \leq 0$). Equation (2.2) and (2.3) are constraints on income and time respectively. DeSerpa (1971:830) defines equation (2.4) as the technical constraint that defines the minimum time required to consume good *i*. The lagrangian is constructed as:

$$L = U(X_1,\ldots,X_n,T_1,\ldots,T_n) + \lambda\left(I - \sum_{i=1}^{n} P_i X_i\right) + \mu\left(T^0 - \sum_{i=1}^{n} T_i\right) + \sum_{i=1}^{n} K_i(T_i - a_i X_i) \quad (2.5)$$

$$given\ K_i \geq 0,\ i = 1,\ldots,n\ and\ \mu\, and\ \lambda > 0$$

where DeSerpa (1971:830) defines λ as the marginal utility of money and μ as the marginal utility of time. Both of these Lagrange multipliers are strictly positive which means that the constraint for time and income will always bind. K_i is the shadow price of the technical constraint, where it's value depend on activity *i*. The first order conditions are:

$$\frac{\partial U}{\partial X_i} = \lambda P_i + K_i a_i \quad (2.6)$$

$$\frac{\partial U}{\partial T_i} = \mu - K_i \quad (2.7)$$

The last constraint yields

$$K_i(T_i - a_i X_i) = 0 \quad (2.8)$$

Rearranging equation (2.8) and dividing by λ gives us VTTS by consuming X_i as:

$$\frac{K_i}{\lambda} = \frac{\mu}{\lambda} - \frac{\partial U / \partial T_i}{\lambda} \quad (2.9)$$

With this framework DeSerpa (1971:833) defines three concepts of value of time (VOT). One is the *value of time as a resource* (VTR), which is the value of extending the time period. VTR is defined as μ / λ; the marginal rate of substitution between total time and money. Another is *value of time as a commodity* (VTC), which is the value of time allocated to a certain activity. VTC is defined as $(\partial U / \partial T_i) / \lambda$, the rate of substitution between a certain activity and money.[9] The third concept is the *value of saving time in activity i*, defined as K_i / λ, where K_i is the lagrange multiplier associated with the corresponding minimum travel-time constraint. K_i / λ indicates how an individual value reduced time in a certain

[9] I also refer to this as the *direct utility* of a certain activity, throughout my thesis.

activity (Jara Diaz, 2000), and is defined as *value of travel time savings* (VTTS) since this study only treat travel time.[10] Based on the definitions above (2.9) becomes:

$$VTTS = VTR - VTC \tag{2.10}$$

With this framework VTTS becomes an individual choice to spend more time than required consuming X_i. A higher VTR will increase the VTTS, while a higher VTC will decrease the VTTS. This deviates from Becker's (1965) framework where VTTS was valued at the wage rate irrespective of activity. DeSerpa (1971) defines *pure-leisure* (or purely enjoyable) activities as activities where the individual voluntarily assigns more time than the required minimum (Jara-Diaz and Guevara, 2002:32). *Intermediate activities* are the most realistic in the context of travelling, and would be the focus of this study. *Intermediate activities* are activities where an individual derives a direct utility that can be substituted with an alternative activity (DeSerpa, 1971, Jara-Diaz, 2000), a relationship shown in equation (2.10).

Though economic theory is important to understand the concept of VTTS, theory alone is not sufficient (Hensher 2007; Ramjerdi, 1993). To model time allocation, econometric models such as discrete choice models have proved useful (Train, 2009). Before presenting my discrete choice model, I will go through relevant literature on value of time.

[10] Jara-Diaz (2000) and Hess et al. (2005) have shown that the marginal rate of substitution (MRS) between time and cost parameters in the utility of a discrete choice model is precisely equal to the ratio κ_i / λ .

3 LITERATURE REVIEW

Though theory on value of travel time is well established within the field of transportation economics, literature on value of travel time for cycling is not ample (Börjesson and Eliasson**,** 2012:674). As far as the study find out there is no previous Norwegian study that has analysed the variation in VTTS among cyclists, and only a few studies reports on the average VTTS. This fact increases the importance of new research on VOT for cyclists in Norway, but limits the literature to be reviewed. For the literature review the study will rely to Norwegian and Swedish papers, since there is an expectation of comparability, but the study have also refer to a few international VTTS-studies. The literature review focuses on the studies by Ramjerdi et al. (2010b) (read: the NVTS), Flügel et al. (2013), Börjesson and Eliasson (2012), as well as Börjesson (2009).[11] A number of other studies are also included to cover issues not mention in these studies.

3.1 VALUE OF TRAVEL TIME SAVINGS FOR CYCLISTS

The first study to report a VTTS for cyclists in Norway was undertaken by Stangeby in 1997. This study found a VTTS of 59 NOK/hr for cyclists, based on a group of car drivers with cycling as an alternative. A shortcoming of this study is that the VTTS is only estimated for those who have access to a car. Over the years estimation and experimental design related to VTTS have become more credible. In 2010 Ramjerdi et al. found an average VTTS of 130 NOK/hr for Norwegian cyclists, while in 2013 Flügel et al. found an average VTTS of 164 NOK/hr utilizing a mixed logit model.[12] Both estimates were higher than the VTTS of their respective alternative modes, a result that is common in the literature (Börjesson and Eliasson, 2012; Börjesson, 2009). Börjesson and Eliasson (2012) explain the higher VTTS for cyclists by a low direct utility (VTC) of cycling. They argue that it is less comfortable to cycle compared to other modes (ceteris paribus), which gives cyclists a higher willingness to pay to shorten travel time. Another explanation could be that cyclists have a higher VTR than other travellers, which will increase their VTTS. Börjesson and Eliasson (2012:679) argue that this is not the case since VTTS of alternative modes are equal for cyclists and other travellers.

Many VTTS-studies reports VTTS in either mixed traffic or on separate cycle paths. VTTS in mixed traffic is higher than on separated paths because it is less safe and comfortable to cycle

[11] Because I use SP-design in my experiment, my literature review covers SP-studies only.
[12] The same questionnaire is used in both studies.

in mixed traffic. Börjesson (2009:5) finds a VTTS for cycling estimated to be 137 NOK/hr in mixed traffic and 91 NOK/hr on cycle path. Börjesson and Eliasson (2012) found a VTTS of 119 NOK/hr in mixed traffic and 79 NOK/hr on cycle path, while the Norwegian study by Flügel et al. (2013:23) got 190 NOK/hr in mixed traffic and 141 NOK/hr on cycle path. These values can easily be transformed to average VTTS-values to enable comparison, as the thesis will not calculate VTTS for mixed traffic or cycle path. These studies also reports higher VTTS for cycle compared to the alternative modes. Börjesson and Eliasson (2012:679) get 51 NOK/hr in average VTTS for the alternative modes. They state that car VTTS-values were higher than their public transport (PT) VTTS-values. Börjesson (2009) gets 64 NOK/h, and Flügel et al. (2013:3) get 84 NOK/hr in average VTTS for the alternative modes.

3.2 VARIABLES AFFECTING THE VALUE OF TRAVEL TIME SAVINGS

Wardman, Tight and Page (1997) and Heinen et al., (2010) suggest that variables affecting VTTS for cyclists are different from those affecting VTTS for car and public transport. Evidence from theory and literature show that higher income lead to lower marginal utility of money, which results in higher VTTS (Small, 2012).

Börjesson (2009) finds no significant difference in VTTS between young and old. Numbers of stops have a direct impact on the time usage and cause irritation and delays, thus more stops increases the VTTS of cyclists (Ramjerdi et al., 2010b). In general work trips have stronger time constraints, which increase VTTS (Börjesson and Eliasson, 2012:675). Börjesson (2009:34) and Börjesson and Eliasson (2012:678) finds no difference in average VTTS between women and men. Heinen et al. (2010:69) claims that the gender difference regarding to cycling is country specific, and that countries with a low share of cyclists, men tend to cycle more, while in countries with a higher share of cyclists such, as Netherlands, Belgium and the Nordic countries, the gender-difference is small.

Longer trips are less comfortable, which increases the VTTS (Noland and Kunreuther, 1995; Fosgerau, 2006; Börjesson, 2009). Some people, such as athletes, cycle precisely because of the effort needed on longer trips. This group of cyclists have a higher VTC of long distance journeys which gives them a lower VTTS. Thus, it is common to divide respondents into long and short trips in VTTS-studies. But also on short trips cyclists use the cycling trip as a substitute for other sport activities and this might increase their direct utility of cycling. Because of this it might be hard to calculate VTTS because there are factors that pull in both directions. This is one of the reasons why VTTS-results might be ambiguous, and well planned estimations and analyzes are needed.

There are some discussions whether weather affects VTTS. Bad weather would increase the VTTS because it makes a given trip less comfortable, but the results might be related to whether it was raining before the trip or not. Börjesson (2009) claims that people that chose to cycle when it rains care less about bad weather, which might give them a lower VTTS in rainy weather. Obviously, some variables are more individual-specific than others.

4 METHOD

The method applied in this thesis follows the approach by Train (2009) and Ben-Akiva et al. (2010) on discrete choice models, utilizing the mixed logit model developed by McFadden and Train (2000). This chapter introduces the study's model, explains the discrete choice framework, properties of the mixed model and gradually builds up a toolkit that will make it possible to estimate the VTTS for cyclists. First I will introduce the study's model.

4.1 THE MIXED LOGIT MODEL

According to Train (2009:11) "discrete choice models describe decision makers' choices among alternatives". In this context alternatives are specified by utility function and choices are based on utility maximisation. There are many discrete choice models and the mixed logit model or mixed multinomial logit model (MNL), introduced by McFadden and Train (2000), has increasingly become one of the more popular in VTTS-studies (Hess et al., 2005:222).

The study's discrete choice model is a set of utility functions for different transport alternatives:

$$U_{nj} = \alpha_{nj} + \beta'_{tj} T_{nj} + \beta_{cj} C_{nj} + \delta_n Z_{nj} + \varepsilon_{nj} \tag{4.1}$$

Utilities are mixed logit models with normal distributed time-coefficients, $\beta_{tj}^{'}$ with density function $f(\beta_t)$ and parameter θ. U_{nj} is the utility for alternative *j* and individual *n*, α_{nj} is the alternative specific constants (ASC), β_{cj} is the coefficient for cost (C), Z_{nj} is a vector of covariates with parameters δ_n and ε_{nj} is a random term that is an independent and identically distributed (iid) extreme value.[13] The three alternative modes that will be included in my model are *cycle*, *car* and *PT* (public transport). Thus, the discrete choice model can be presented as:

$$\begin{aligned} U_{ncar} &= \alpha_{ncar} + \beta'_{tcar} T_{ncar} + \beta_c C_{ncar} + \upsilon_n Z_{ncar} + \varepsilon_{ncar} \\ U_{ncyc} &= \alpha_{ncyc} + \beta'_{tcyc} T_{ncyc} + \upsilon_n Z_{ncyc} + \varepsilon_{ncyc} \\ U_{nPT} &= \beta'_{tPT} T_{nPT} + \beta_c C_{nPT} + \upsilon_n Z_{nPT} + \varepsilon_{nPT} \end{aligned} \tag{4.2}$$

13 Independent and identically distributed (iid) error terms has the same distribution for all alternatives. Independent means that the error terms are uncorrelated over alternatives, while identical means that it has the same variance for all alternatives (Stock and Watson, 2012).

It is important to notice that there are no cost-coefficient for *cycle*, as there are no monetary cost associated with this mode. To be able to identify cyclists' utility of money it is necessary to include alternative modes with a monetary cost. The time-coefficients are modelled separately for each alternative, which makes it possible to distinguish different VTTS-values for different modes. To be able to estimate different VTTS over alternatives, cost-coefficients are specified to have the same scale. The ASC is fixed for *PT* to be able to identify choices of utility (Train, 2009). It is wrong to refer to the left side of equation (4.1) as a dependent variable, which is common for basic regression models. For discrete choice models the left side variable is measuring the probability of some choice instead of a causal relation (Train, 2009).

Utilizing the discrete choice framework, presented below, makes it possible to estimate the time- and cost-coefficient as well as parameterized attributes.

4.2 INTRODUCING THE DISCRETE CHOICE FRAMEWORK

Discrete choice models are grounded on its choice set, which Train (2009:11) defines as "all the different alternatives an individual can choose from". A choice set inhabits three important characteristics: First of all, it is *mutually exclusive*; choosing *cycle* excludes the possibility of choosing another mode. Secondly, the choice set is *exhaustive*; meaning that all possible alternatives are included. Finally, the number of alternatives must be *finite*, thus there could be no more alternatives than those included in the choice set (Train, 2009).

4.2.1 CHOICE IDENTIFICATION

Discrete choice models assume utility-maximizing behaviour by the decision makers. This implies that decision maker *n* will choose *cycle* if and only if $U_{cyc} > U_{car} \; \forall \, cyc \neq car$, which means that the utility of *cycle* must exceed the utility of the other alternative (which is *car* in this case), given that the alternative is different.[14]

It is not possible to observe the true utility of an individual (U_{nj}), but I will be able to measure V_{nj}, which is called the *indirect utility* (or *representative utility*) (Train, 2009:15). Parts of utility that we cannot observe makes $V_{nj} \neq U_{nj}$ and utility can be decomposed to $U_{nj} = V_{nj} + \varepsilon_{nj}$. The probability that any decision maker *n* chooses *cycle* is:

$$P_{ncyc} = Prob(U_{ncyc} > U_{ncar} \; \forall \, cyc \neq car)$$

[14] I will continue to use *car* and *cycle* is examples. Obviously, *car* could be replaced by *PT*.

$$= Prob(V_{ncyc} + \varepsilon_{ncyc} > V_{ncar} + \varepsilon_{ncar} \ \forall \, cyc \neq car)$$

$$= Prob(V_{ncyc} - V_{ncar} > \varepsilon_{ncar} - \varepsilon_{ncyc} \ \forall \, cyc \neq car) \tag{4.3}$$

The choice probability in (4.3) shows that in this case *cycle* is the most preferred mode. Equation (4.3) illustrates the fact that only the *difference* between utilities is relevant for the choice probability, and not the utility itself. In general, this means that the only appropriate parameters to be estimated are those that capture differences across alternatives (Train, 2009).

The probability function in (4.3) have some important properties. First of all, it is a number between zero and one ($0 \leq P_{nj} \leq 1$) for any alternative, and secondly all probabilities sum to one as $\sum_{j=1}^{J} P_{nj} = 1$, where J is the total number of alternatives. Finally the expected share choosing *cycle* (s_{cyc}) can be formulated as $s_{cyc} = \frac{1}{N} \sum_{n=1}^{N} P_{ncyc}$, where N is the total number of individuals which makes this expression an average over cyclists. Based on this information the probability of choosing *cycle* is:

$$P_{ncyc} = \int_{\eta} I(V_{ncyc} - V_{ncar} > \eta_{ncar} - \eta_{ncyc} \ \forall \, cyc \neq car) \, f(\eta_n) d\eta_n \tag{4.4}$$

where $I(\cdot)$ is the indicator function equalling 1 when the expression in the parenthesis is true and 0 otherwise. The choice probability is an integral over the unobserved proportion of utility (Train, 2009).

α_j is called the *alternative specific constant* (ASC) and captures the average effect on utility of un-included factors for one alternative relative to the others. Adding a constant to all utility functions in (4.2), will not make any difference as the difference between the constant are the same: $\alpha_{car}^1 - \alpha_{cyc}^1 - \alpha_{PT}^1 = d = \alpha_{car}^0 - \alpha_{cyc}^0 - \alpha_{PT}^0$. To account for this I need to normalize one of the constants to zero: $\alpha_{car} = 0$ (Train, 2009:20). Then the value of the ASC for *cycle* is $\alpha_{cyc} = d - \alpha_{PT}$, which is interpreted as the average errors of *cycle* to the other alternatives. Which constant that is normalized is irrelevant as only the relative difference is important (Train, 2009: 21).

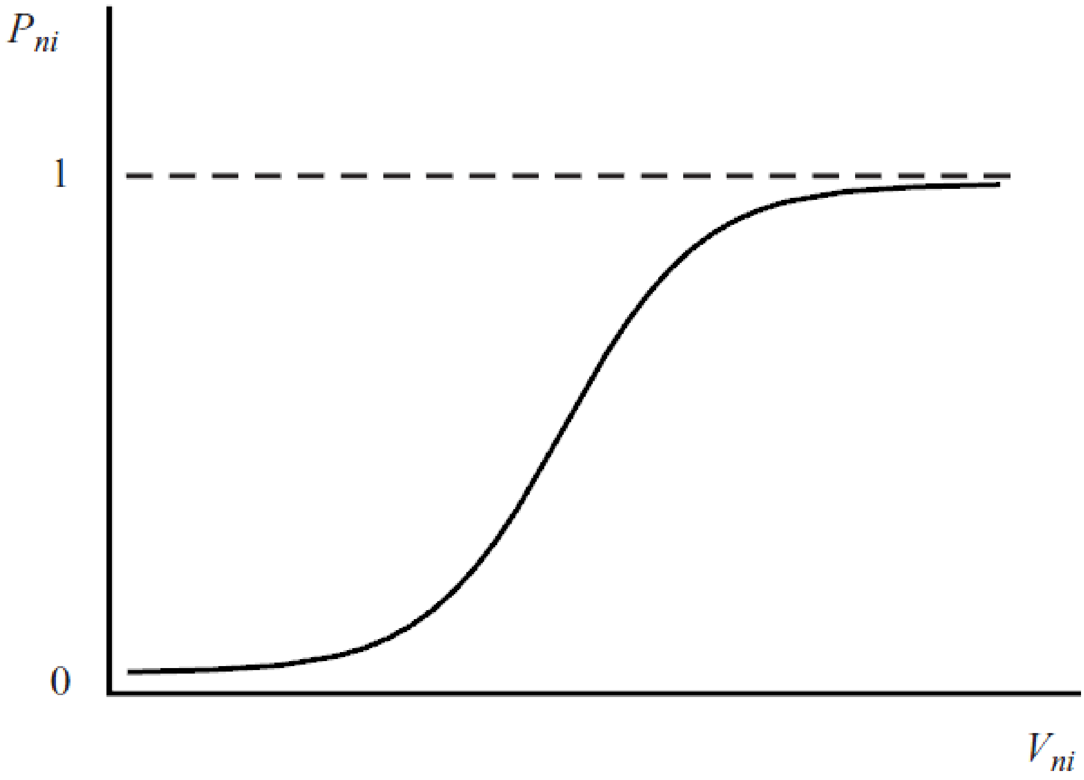
4.3 MODEL SPECIFICATION

Having explained the discrete choice framework I will proceed with the specification of the mixed logit model. First I will introduce the multinomial logit (MNL) that makes up the basic framework of the logit models.

4.3.1 MULTINOMIAL LOGIT

Initially, virtually all transportation research on VTTS were based on the multinomial logit (MNL) model (Hess et.al., 2005), which is a standard logit model with more than two alternatives. This type of model is easy to implement and estimate, but has some adverse limitations.

Figure 4:1: The logit distribution is S-shaped



Source: (Train, 2009:38).

The standard logit probability of choosing *cycle* can be written as:

$$L_{ncyc}(\beta) = \frac{e^{V_{ncyc}(\beta)}}{\sum_{j=1}^{J} e^{V_{nj}(\beta)}} \tag{4.5}$$

This shows the standard logit probability as a closed form expression where the probability to choose *cycle* is the utility of cycling, averaged of all alternatives. The probability is somewhere between zero and one, and the total choice probability is summed up to 1, which can be seen in Figure 4:1 (Train, 2009:37). The more utility an individual gets form a certain alternative, the higher is the probability that the individual will choose this alternative. The S-shape tells us that the marginal effect at the tails are low, which means that a change in utility at the tails gives a small change in probability. For individuals that are less determined (where probability is closer to 0.5), such a change will result in a stronger marginal effect of an increase in the utility of cycling.

The logit model exhibits the properties of the *independence from irrelevant alternatives* (IIA), derived by Luce (1959), and is consistent with utility maximization showed by Marschak (1960). The IIA axiom states that the ratio of choice probabilities for alterative *i* and *j* is the same for every choice set C, that includes both *i* and *j* (McFadden, 2000:333).[15] Unobserved utility is independently and identically distributed extreme value (McFadden, 2000). These restrictive assumptions makes the logit model unsuitable for the analysis in this study. Therefore the study proceeds with the mixed logit model, which builds on the multinomial logit foundations.

4.3.2 MIXED LOGIT

The mixed logit model is convenient because it allows randomness in parameters that accommodates taste variation (Train, 2009), which is highly relevant for VTTS studies as random taste heterogeneity has repeatedly been shown to exist in marginal utility of travel time (e.g. Algers et al., 1998; Chirillo and Axhausen, 2004). McFadden and Train (2000) shows that any true choice model can be approximated to any degree of accuracy by a mixed logit, with appropriate specification of explanatory variables and distribution of coefficients. A coefficient where random taste heterogeneity has repeatedly been shown is the marginal utility of travel-time (Train, 2009). The *random coefficients* of the mixed logit lets the coefficients vary over decision makers rather than being fixed, which is useful to account for taste variation across individuals.

Choice probabilities in the mixed logit model take the form of

$$P_{ni} = \int L_{ni}(\beta) f(\beta) d\beta \qquad (4.6)$$

[15] i.e., $P_C(i)/P_C(j)=P_{\{i,j\}}(i)/P_{\{i,j\}}(j)$

The *mixing distribution* $f(\beta)$ is a density function for the vector parameter β, and $L_{ni}(\beta)$ is the standard logit probability.[16] The mixed logit has its name because it is a product of the logit, mixed over a density of coefficients, with weights given by $f(\beta)$ (Train, 2009:135). The parameter vector density function is called the mixing distribution because it is a combination of other probability distributions written as $f(\beta|g(\theta))$ or simply $f(\beta|\theta)$. The parameter vector β is conditional on θ, which has its own distribution calculated by maximum likelihood (Train, 2009:136), which will be explained in part 4.3.3.

The mixed logit error term consists of two parts; $\eta_{nj} = \upsilon_n z_{nj} + \varepsilon_{nj}$, where $\upsilon_n z_{nj}$ has a distribution (i.e. it is the error of the time-coefficient distribution) that can be correlation over alternatives (depending on the specification of z_{nj}), and ε_{nj} has the same properties as the familiar standard logit error term.[17] The error components are uncorrelated for every utility function, while $\upsilon_n z_{nj}$ can be correlated across alternatives, which is one of the biggest advantages of the mixed logit model (Train, 2009).[18]

In a mixed logit a percentage change for one alternative gives a percentage change in the m[th] attribute of another alternative, which Train (2009:141) formulates as:

$$E_{nix_{nj}^m} = -\frac{x_{nj}^m}{P_{ni}} \int \beta^m L_{ni}(\beta) L_{nj}(\beta) f(\beta) d\beta = -x_{nj}^m \int \beta^m \left[\frac{L_{ni}(\beta)}{P_{ni}} \right] L_{nj}(\beta) f(\beta) d\beta \qquad (4.7)$$

where β^m is the m^{th} element of β. It is important to notice that the elasticity is different for each alternative. In this way the relative percentage change in alternatives depend on correlation between the different alternatives (Train, 2009:141).

4.3.3 Maximum likelihood estimation

The maximum likelihood estimators (MLE) are the estimators that maximize the maximum likelihood function (MLF), because they are the values of the parameters for which the observed sample is most likely to have occurred (Ben-Akiva and Lerman, 1985:20). Maximising the likelihood function is equal to maximising the log-likelihood function, which is globally concave (Train 2009:61). The maximum likelihood estimates gives the predicted

---

[16] $L_{ni}(\beta) = P_{ni}$, where P_{ni} was described in chapter 4.3.1.

[17] It is easy to see that for the multinomial logit model z_{nj} is zero, which leaves us with ε_{nj} only.

[18] Correlation over alternative can be specified to $\mathrm{cov}(\eta_{ni}, \eta_{nj}) = E(\upsilon_n z_{ni} + \varepsilon_{ni})(\upsilon_n z_{nj} + \varepsilon_{nj}) = z_{ni} W z_{nj}$, where W is the covariance of υ_n.

average of each explanatory variable equal to the observed average in the sample (Train 2009:62), and is done automatically in Biogeme 2.0. The log-likelihood will always be negative; where less negative values (closer to zero) indicates a better fit of the model and more credible estimates.

4.3.4 SIMULATION

Biogeme 2.0. uses simulation in order to obtain choice probabilities in the mixed logit model (Train, 2009:144). Simulation estimates the conditional set of parameters θ. The simulation procedure follows a three-step procedure (Train, 2009:144). First, a value is drawn from $f(\beta|\theta)$ labelled β^r, where $r \in (1, R)$ and $r = 1$ refers to the first draw, and R is the total amount of draws. Second, the mixed logit formula $L_{ni}(\beta^r)$ is calculated with the current draw. Third, the first and second step is repeated many times. Averaging the results over R draws gives the simulated probability of individual n choosing alternative i:

$$\hat{P}_{ni} \approx \frac{1}{R}\sum_{r=1}^{R} L_{ni}(\beta^r)$$

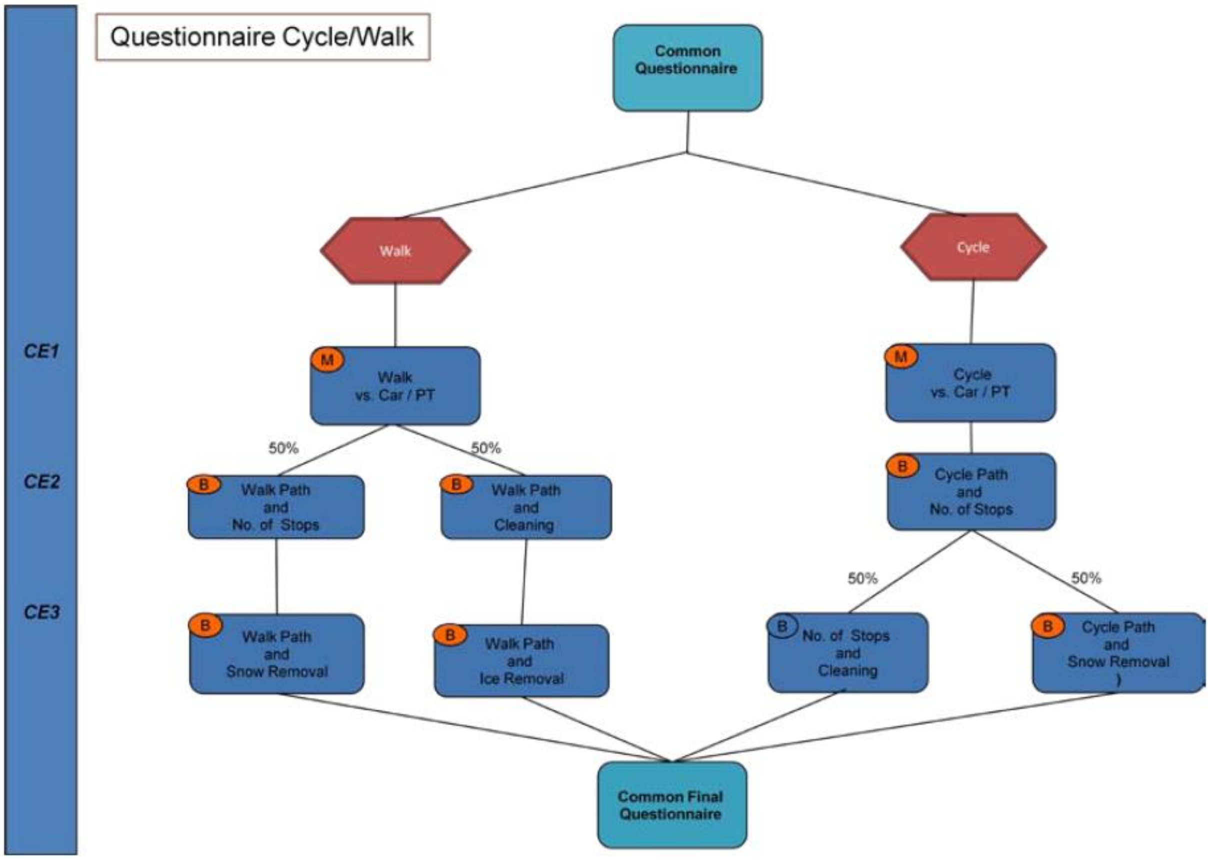
$$\lim_{R\to\infty} \frac{1}{R}\sum_{r=1}^{R} L_{ni}(\beta^r) = \int L_{ni}(\beta) f(\beta) d\beta \tag{4.8}$$

Averaging makes $\hat{P}_{ni}$ an unbiased estimator of P_{ni} by construction (Train, 2009:144). When the number of draws approaches infinity, the simulated probability equals the mixed logit probability (Train, 2009:144, Bierlaire, 2010). For the analysis this study uses 700 or 500 Halton draws to simulate the likelihood function in Biogeme 2.0.

5 SURVEY DESIGN

The data material was collected by *Synovate Norway*, with a survey designed by TØI. Members of the *Synovate Norway* internet panel were asked to take part in the study, and data were gathered in both 2009 and 2010. The participants in the survey were over 18 years old.

Figure 5:1: Questionnaire for Cycle/Walk (Ramjerdi et al., 2010b)



5.1 QUESTIONNAIRE

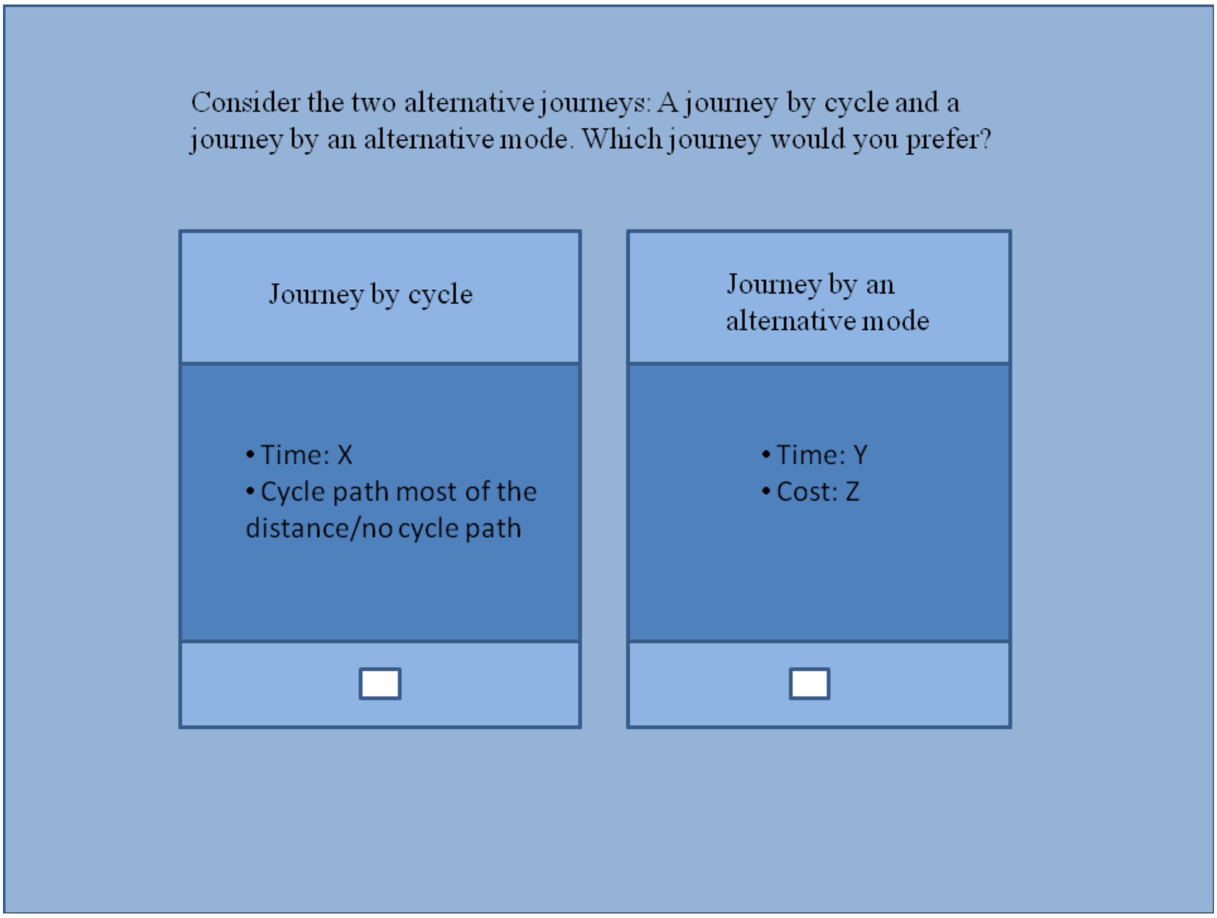
The survey is divided in different questionnaires for short distance travels, long distance travel, walking and cycling. Cyclists were allocated to their respective questionnaire if they confirmed to have made a trip by bike over 10 min the previous week.[19] Those who had performed more than one trip were asked to focus on the longest trip when answering the subsequent questions. The survey did not include business travels such as travels that are paid

[19] This had to be a continuous trip of ten or more minutes, so a journey back an fourth to the grocery store did on for instance 12 minutes, do not count as this would count as two trips on approximate 6 minutes (Ramjerdi et al., 2010b).

by a company or employer or trips made for leisure.[20] Apart from this all possible travels are included in the questionnaire.

Figure 5:1 is an overview of the survey for walking and cycling. The survey contains a common questionnaire, with personal background questions, and a mode-specific questionnaire. The common questionnaire is split in two, and placed at the beginning and in the end of the survey. Some respondents might be restrictive in giving out personal information, thus splitting the sensitive part helps to reduce drop-outs.

Figure 5:2: Mode choice experiment



5.2 EXPERIMENT

The study's analysis and estimation on VTTS is based on the mode choice experiment shown in Figure 5:2, which is part M of the survey in Figure 4:1. The experiment is a standard mode choice experiment with SP-design. The respondent has to make a choice between either cycling or his/her alternative mode. There are two attributes to this experiment; time and cost for the alternative mode, and time and cycle path for cycling. The alternative mode for an

[20] The VTTS-literature covers few studies on business travels because it is complex to identify correct cost- and time coefficients for this particular travel purpose.

individual cyclist could be either car or public transport. The mode choice is designed to reveal the mode that is preferred by the individual, given the choice sets in Figure 5:2. Time and cost where randomly drawn from a database with different alternatives.[21] The length of the cycle path was also randomly drawn to give the highest credibility. Dominant alternatives were excluded, which would otherwise bias the results (Ramjerdi et al., 2010b). Since there is no monetary cost associated with cycle, the inclusion of a mode with monetary cost is necessary to generate the cost coefficient. The generated value for each attribute is hypothetical, but realistic, and by investigating the choices of the cyclists it is possible to measure VTTS. Eight different choice sets were presented to each individual, where the mode presented on the right or left side was randomized to limit *lexicographical answers*; answers that always follow a certain attribute (such as the cheapest alternative). The design was also made clear to limit *order effects*, which is effects that occur in case there is something instinct in the design that favours one of the alternatives.

[21] On average the alternative mode was faster than cycle to reveal the willingness to pay for a faster alternative. Travel time was defined as door to door time (Ramjerdi et al. 2010b).

6 DATA

The data used in this study was first gathered in June/July 2009, but due to some problems in the second wave of the 2009-survey a new collection was undertaken in 2010. The problems that occurred in 2009 did not affect the NVTS or my part of the data material. Since the collection was performed twice, I was able to increase the number of cyclists, by merging the data sets from 2009 and 2010. The 2009-survey was sent out to 47000 people, where 9280 people answered after two reminders. This equals a response rate of 19.74 %, where 901 of the respondents were cyclists. The 2010-survey was sent out in April/May and after two reminders the response rate was 21.98%, where 2232 of the respondents were cyclists. Combining the datasets from 2009 and 2010 gives me a panel data of 3133 cyclists in total.

My study focuses on intermediate trip, which makes it natural to exclude trips where the only intention is exercise, but keep those journeys where exercise is part of the trip. Thus, I exclude cyclists with speed over 30 km/hr, trip length over 50 km or travel time over 120 minutes, as I expect these to fall outside the definition of an *intermediate trip* (see chapter 2). In total I excluded 1085 cyclists, which left me with 2048 cyclists in my final dataset. This means that I excluded almost 35 % of the sample, which is a large amount. This means that many of the respondents were actually cycling longer trips or having high speed. Due to limitations on the design of the experiments, the survey puts a lower limit on 10 min continuous cycle trips, which obviously exclude many short-time trips. Otherwise the high percentage of long trips among respondents might have been different. It means that it is hard to extract any knowledge out of this. The only certain fact is that I look at VTTS for intermediate trips by excluding the extreme cases.

My dataset contains background variables, trip specific variables and mode-specific variables. Most of these variables are categorical variables, which I describe by frequencies, while the other is continuous, which I describe by descriptive statistics.

6.1 COMPARING CYCLISTS TO THE NATIONAL AVERAGE

The analysis in Table 6:1 compares my dataset to the national average values from 2009/10. This analysis is interesting because it gives a perception about properties of the cyclists and how representative they are compared to the total population. When analysing these results it is important to keep in mind that my data do not contain people below 18 years and few people over 70. Since the national average reflects the national proliferation of age, I try to limit it to make it suitable for comparison. This procedure was only possible for the second part of the Table 6:3, as national data were limited. Thus, the first part of the table compares my data to the total national average while the second compares my data with the national population between 16 and 77 (read: restricted national average).

The first rows in Table 6:3 shows the geographical spread of data by cities and counties, and shows that the data material is representative in this manner. The only places with a clear deviation for the national average are Troms and Finnmark, which is expected given the climate and weather conditions in these areas. I define urban areas as cities with over 100000 inhabitants, and by looking at these numbers I see that my data material corresponds with the national average values except for Trondheim, that could be a coincidence.[22] On average my sample includes more urban people than the national average.

The second part of the Table 6:1 presents a slightly more comparable analysis, as I was able to restrict the national average values. I find this procedure credible as one is more likely to travel with any mode at this age level (16-77 years). People at this age level also have a better perception about their traffic preferences. As only two percent of the cyclists are above 69 years old I choose to exclude these from the comparison. Looking for discrepancies I find that a higher percentage of the cyclists are men, and there are fewer cyclists among the older generation, compared to the restricted national average. On average the cyclists have higher income, are much better educated and a higher percentage of employment than the restricted national average (see Table 6:1). A higher percentage of the cyclists are working full time, while the rate of part-time workers is quite similar to the restricted national average. One reason why cyclists have a lower unemployment might be that they are higher educated, and in this case they have a higher alternative cost by not working.

Table 6:1: Average values of Norwegian cyclists and population in 2009/10

Variable	Cyclists	National average values
Residence by county[23]		
Østfold	4.9 %	5.6 %
Akershus	11.5 %	11.0 %
Oslo	18.0 %	12.0 %
Hedmark	3.2 %	4.0 %
Oppland	2.9 %	3.8 %
Buskerud	3.3 %	5.3 %
Vestfold	7.0 %	4.8 %
Telemark	3.3 %	3.5 %
Aust-Agder	1.7 %	2.2 %
Vest-Agder	3.1 %	3.5 %
Rogaland	10.0 %	8.8 %
Hordaland	7.8 %	10.0 %
Sogn og Fjordane	1.3 %	2.2 %

[22] Or maybe not, as Sælensminde (2002) also shows the percentage of cyclists in Trondheim to be quite high.
[23] National average values are found in SSB statistical yearbook (2009:67).

Møre og Romsdal ***Sør-Trøndelag*** ***Nord-Trøndelag*** ***Nordland*** ***Troms*** ***Finnmark*** ***Missing***	3.3 % 9.8 % 2.1% 4.2 % 1.8 % 0.1 % 0.7 %	5.2 % 6.0 % 2.7 % 4.9 % 3.2 % 1.5 %
Residents in urban areas (defined as cities with over 100000 inhabitants[24]) ***Oslo*** ***Bergen*** ***Stavanger/Sandnes*** ***Trondheim*** ***Percentage of total data sample/population*** ***Missing***	 18.04% 5.72% 3.76% 8.52% 36.04% 0.4 %	 18.26 % 4.75 % 3.96 % 3.34 % 30.30 %

Variable	Cyclists (n = 2048)	Restricted national average (values of people between 15 and 75 years old) (n = 3188665)
Gender[25] ***Percentage men*** ***Missing***	 56 % 0 %	 50.7 %
Age[26] ***18-29*** ***30-39*** ***40-49*** ***50-59*** ***60-69*** ***Missing***	 21.70% 19.78% 24.34% 21.07% 13.11% 2 %	 22.74% 21.38% 21.58% 19.07% 15.23%
Net income [27] **Missing**	309550 5 %	290700
Education[28] ***Primary school*** ***High School*** ***University / University collage*** ***Missing***	 3.5 % 24.2 % 72.0 % 0.1 %	 26.5 % 40.63 % 27.3 %
Employment[29] ***Fulltime*** ***Parttime*** ***Non-working*** ***Missing***	 68 % 19.1 % 12.7 % 0.2 %	 51.45 % 18.94 % 29.61 %

Note: First part: Average values of cyclists compared to average values of the Norwegian population in 2009/10. Second part: Average values of cyclists compared to average values of the Norwegian population between 16 and 77 years old in 2009/10.

6.2 FREQUENCIES AND DESCRIPTIVE STATISTICS

Table 6:2 and Table 6:3 show descriptive statistics and frequencies for the variables used in the analysis. Overall, there are few missing variables. The descriptive statistics in Table 6:2 gives a clear indication of the distribution of each variable. The first row shows that an average person in my data set is 45 years old and has an income of 309550 NOK. The data set contains more men than woman. The average speed in the reference trip is 14.16 km/h and

[24] National average values are found in SSB statistical yearbook (2010:70).
[25] National average value are found in SSB statistical yearbook (2009:92)
[26] National average values are found in SSB statistical yearbook (2009:92-94).
[27] Gross average income is found in SSB statistical yearbook (2012:186).
[28] National average values are found in SSB statistical yearbook (2010:181)
[29] National average values are found in SSB statistical yearbook (2010:202)

there are on average 1.68 stops per kilometre. The unacceptable distance that a respondent is willing to travel is more than three times the uncomfortable distance. A larger percentage of cyclists states exercise as an important reason to cycle, but for this variable there are many missing variables. A higher percentage of the sample cycles in good weather, works full time, sees exercise as the most important reason to cycle, commutes to work and cycles in weekdays.

Table 6:2: Descriptive statistics of variables included in the model

Variable	Mean	Standard Deviation	Min	Max	Number of respondents (missing)
Total (n = 2289)					
Age(years)	45	14	18	86	2048 (0)
Net income (NOK)	309550	122254	88504	584734	1939 (109)
Speed(km/h)	14.16	5.58	1.09	29.41	2047 (1)
Stop per km	1.68	1.75	0.06	30	1990 (58)
Uncomfortable distance (km)	32.81	20.62	1	200	2046 (2)
Unacceptable distance (km)	99.68	196.77	1	6000	2038 (10)

Table 6:3: Frequencies of variables

Variable	Total (n = 2048)	Variable	Total (n = 2048)
Gender		**Day of travel**	
Percentage male	56 %	*Weekday*	81.5 %
Percentage female	44 %	*Weekend*	18.5 %
Missing	0%	*Missing*	0 %
Travel purpose		**Exercise**	
Commute to work	46.0 %	*Less because I cycle*	11.1 %
Commute to school	3.2 %	*Equal amount because I cycle*	22.0 %
Shopping	12.4 %	*More because I cycle*	13.2 %
Service (bank, post, hairdresser etc)	2.4 %	*Don't know*	3.7 %
Visit friends or relatives	10.8 %	*Missing*	50 %
Pick up or deliver children	2.1 %		
Other	23 %		
Missing	0 %		
Education		**Annual Net income**	
Primary school	3.5 %	*High income (over 400000 NOK)*	16.7 %
High School	24.2 %	*Medium high income (300000 - 400000 NOK)*	34.5 %
1 – 4 years of university	37.3 %	*Medium low income (200000 - 300000 NOK)*	23.7 %
More than 4 years of university	35.0 %	*Low income (100000 - 200000 NOK)*	13.7 %
Missing	0.1 %	*Very low income (under 100000 NOK)*	7.1 %
		Missing	0.06 %
Reason to choose cycle as transport mode in the experiment		**Residents in cities with over 100000 inhabitants**	
		Oslo	18.0 %
Environment	3.3 %	*Bergen*	5.7 %
Exercise	15.8 %	*Stavanger/Sandnes*	3.9 %
Flexible	9.6 %	*Trondheim*	8.6 %
Other	4.3 %	*Percentage of sample*	36.2 %
Missing	67 %		0.4 %
Weather while travelling in reference trip		Employment status	
Good	84.6 %	***Full-time***	68.0 %
Bad	12.6 %	***Part-time, between 35 and 20 hours a week***	10.1 %
Missing	3.3 %	***Part-time, under 20 hours a week***	9.0 %
		Do not work	12.7 %
		Missing	0.2 %

7 ANALYSIS AND RESULTS

This chapter provides analysis and results of the mixed logit model. The model is applied on the total sample as well as on male, female, urban and rural segments. First I discuss the distribution of time-coefficients.

7.1 DISTRIBUTION OF TIME-COEFFICIENTS

It is common to specify the distribution of time-coefficients, and not cost-coefficients, in VTTS-studies, since the former provide the main variation in VTTS (Ramjerdi, 1993). There are various distributions to chose among, but the most common in the VTTS-literature has been normal and lognormal distributions (Hess et al., 2005). Which distribution to choose is difficult and estimates are very sensitive to the assumptions made for the coefficients (Hensher, 2001; Fosgerau, 2006). Since it is common to expect negative estimates for the time-coefficients, one disadvantage with normal distribution is the possibility of producing positive coefficients, but this probability is very small (Hess et al., 2005). The log-normal also has some disadvantages such as slow convergence and a fat tail that might result in overestimation of VTTS (Hess et al., 2005:224).

Table 7:1 shows the mixed logit models, with normal and lognormal distributed time-coefficients, as estimated on my dataset. The table provides important indicators for the goodness of fit of the models. The goodness of fit is a measure of the statistical explanatory power of a model, i.e., the ability of the model to describe the data set at hand (Stock and Watson, 2012:440). A better goodness of fit can for instance be given by a better significance of coefficients, a higher final log-likelihood or adjusted ρ^2.[30] The final log-likelihood is the maximum simulated log-likelihood of the estimated model. A higher final log-likelihood value will increase the adjusted ρ^2, which indicates a better goodness of fit (Train, 2009). The null log-likelihood is the log-likelihood when all coefficients are set equal to zero. This is the same for all the models, since the models are estimated on the same dataset. Since there are

[30] Adjusted ρ^2 is based on the likelihood functions (*LL*) and number of parameters (*K*): $1-\left(\frac{final\ LL-K}{null\ LL}\right)$ (Ben-Akiva and Lerman, 1985). In words the adjusted ρ^2 is comparing values of the maximized likelihood function, with all the regressors, to the value of the likelihood function with none (Stock and Watson, 2012:440). This means that the adjusted ρ^2 is a value between 0 and 1, where a higher value indicates a better goodness of fit. Adjusted ρ^2 is used instead of the regular ρ^2 for interpretation in discrete choice analysis, because the adjusted ρ^2 will not necessarily increase as new parameters are added to the model (Train, 2009). This means that the adjusted ρ^2 will always be less or equal to ρ^2.

eight mode experiments for each cyclist, there are eight times as many observations (*N*) as cyclists. Obviously the number of observations is lower than my total number of respondents, which is due to automatic exclusion of some observations in the estimations, as a result of missing values.

The goodness of fit of the basic MMNL1-models in Table 7:1 is almost identical. But for the parameterized models (MMNL2 and MMNL3), the models with normal distributed time-coefficient shows a slightly better fit. Based on this I choose to specify the distribution of the time-coefficients in my mixed logit models to have a normal distribution.

Table 7:1: Mixed logit with normal and lognormal distributed time coefficients

MODEL	MMNL1 normal	MNNL1 lognormal	MMNL2 normal	MMNL2 lognormal	MMNL3 normal	MMNL3 Lognormal
Adjusted ρ^2	0.389	0.389	0.411	0.409	0.411	0.409
Null log-likelihood	-11294.833	-11294.833	-11294.833	-11294.833	-11294.833	-11294.833
Initial log-likelihood	-10263.442	-116511.101	-10262.399	-104355.167	-10262.399	-116511.101
Final log-likelihood	-6891.490	-6891.505	-6621.449	-6644.640	-6611.679	-6633.040
N	16295	16295	16295	16295	16295	16295

Note: Full models with parameter values are presented in appendix I. MMNL1 and MMNL3 with normal distributed time-coefficients are presented in table 7:4.

7.2 APPLYING THE MIXED LOGIT MODEL

For the analysis I apply the mixed logit model in equation (4.2) with model specifications described up until now. First I prove the superiority of the mixed logit model compared to the multinomial logit model.

7.2.1 MIXED LOGIT COMPARED TO MULTINOMIAL LOGIT

Table 7:2: proves the basic mixed logit, with normal distributed time-coefficients, to have a much better fit than the multinomial logit.[31] Since I estimate the models on the same dataset their null log-likelihood is the same, but the MMNL1 reaches a higher maximum likelihood, and produces a higher final log-likelihood and better adjusted ρ^2. The increase in goodness of fit, compared to the multinomial logit, comes as a result of specifications in the mixed logit.

Both time- and cost-coefficients are negative and significant at the 1% level in both models in Table 7:2. Significance is calculated based on the robust t-test to account for heterogeneity

[31] A description of the different coefficients is presented in “Appendix II: Description of coefficients”.

between alternatives.[32] I use 5 % significance as a limit of significance, which means that 10 % significant coefficients will not be included in my measurements on variations in VTTS.

Overall cost- and time-coefficients is more negative in the MMNL1, compared to the MNL-model. Since the ratio between the time- and cost-coefficient for cycle is larger in the MMNL1, compared to the MNL-model, this results in a higher VTTS for the former. This is likely due to model specifications of the mixed logit model, such as the ability to accommodate taste variation, explained in chapter 4. It is interesting to notice that the robust t-statistics for the ASC for cycle is higher in the MNL-model, than in the MMNL1-model, indicating a smaller average proportion of unexplained variables in the latter.[33]

Table 7:2: Multinomial Logit (MNL) compared to the Mixed Multinomial Logit (MMNL1)

MODEL	MNL	MMNL1
ASC_car	0.210**	0.611***
	[0.0904]	[0.242]
ASC_cycle	1.26***	2.94***
	[0.0794]	[0.226]
ASC_pt	(fixed)	(fixed)
B_cost	-0.0346***	-0.0658***
	[0.00208]	[0.00413]
B_cycVEG_ingen_CYC	(fixed)	(fixed)
B_cycVEG_meste_CYC	1.07***	2.13***
	[0.0375]	[0.0832]
B_time_car	-0.0462***	-0.0975***
	[0.00436]	[0.00971]
B_time_cyc	-0.0842***	-0.178***
	[0.00162]	[0.00529]
B_time_pt	-0.0528***	-0.0830***
	[0.00547]	[0.0116]
SIGMA		3.16
		[1.80e+308]
Error1	(fixed)	(fixed)
Error2	(fixed)	(fixed)
Error3	(fixed)	(fixed)
Error1_s		-0.514***
		[0.0453]
Error2_s		-0.481***
		[0.0525]
Error3_s		0.220***
		[0.184]
sigma_time_car		0.0351
		[0.0349]
sigma_time_cyc		0.0518***
		[0.00328]
sigma_time_pt		-0.00899
		[0.0207]
Adjusted ρ^2	0.218	0.389
Null log-likelihood	-11294.833	-11294.833
Initial log-likelihood	-11294.833	-10263.442
Final log-likelihood	-8822.462	-6891.490
N	16295	16295

*Note: Values of estimated coefficient are presented with robust standard errors in brackets. Significance at the 1, 5, and 10 percentage levels are indicated by ***, ** and *, respectively.*

[32] The robust t-test makes use of the robust standard error $(Rob\,SE(\overline{\beta_X}))$ and is specified as: $Robust\,t{-}test = \frac{\beta_X}{Rob\,SE(\beta_X)}$.

The robust standard error is a consistent estimator of the robust variance, even if there is heteroskedasticity or autocorrelation (Stock and Watson, 2012:420). Because the robust standard error is consistent, we can draw the conclusion that the robust t-test is consistent.

[33] Robust t-statistic for ASC_cycle is 15.87 for MNL and 12.65 for MMNL.

7.2.2 AVERAGE VALUE OF TRAVEL TIME SAVINGS

The mixed logit without parameterization (MMNL1) is presented in the second column in Table 7:2.[34] Time- and cost-coefficients are significant at 1%, which gives me highly credible VTTS-estimates. The model estimates an average VTTS of 162 NOK/hr for a cyclist's willingness to pay to save one hour of travel time.[35] This value is higher than the average VTTS-value of 146 NOK/hr estimated by the MNL-model in Table 7:2. The value is also higher compared to the average found by Ramjerdi et al. (2010b), but very close to the average value reported by Flügel et al. (2013). The strong similarity between my value and the value of the latter is due to the fact that both studies utilize a mixed logit model, which I have shown to have more explanatory power, compared to the multinomial logit model. The VTTS of the alternative modes are smaller than the VTTS for cycle, which is in line with the studies in my literature review, a fact that gives more credibility to my VTTS-estimates for the cyclists.[36]

7.2.3 PARAMETERIZATION

To analyse the variation in VTTS for cyclists I find it most appropriate to parameterize the time-coefficient for cyclists and the cost-coefficient. I parameterize the time- and cost-coefficients with respect to different variables, and one coefficient is estimated for each interaction variable. Most of the interaction variables are included in the model as dummy variables. This means that it is important to fix one of the dummies to avoid perfect multicollinearity, which will occur in case one regressor is an exact linear function of another regressor (Stock and Watson, 2011:811). Variables that are not included as dummies are *unacceptable distance* and *uncomfortable distance.* These variables are coded as mixes of other categorical variables, which make it possible to estimate the desired purpose, without incurring multicollinearity.

I intended to include all variables in Table 6:2 and Table 7:3 in the parameterization, but through a thorough process of initial estimations I excluded a couple of variables from the final models presented in this chapter. This counts for *education*, *travel purpose*, *employment*

[34] For convenience, the same model is also presented in the first columns in Table 7:4.

[35] Appendix IV shows how the average VTTS is calculated.

[36] I get 89 NOK/h in VTTS for car and 76 NOK/h for PT. Interestingly this value is higher than the values reported for alternative modes in the literature review, except of Flügel et al., (2013). Since Flügel et al., (2013) also produces higher VTTS-values for the alternative modes, this might indicate that these studies have a tendency to produce higher VTTS, not only for cycle, but for all modes. On the other hand VTTS of the alternative modes seems to correspond with the average values of other modes in the NVTS. Average VTTS for car (based on car-users) is estimated to 80 NOK/hr and average VTTS for PT (based on PT-users) is estimated to 51 NOK/hr. These numbers are a bit smaller than the average VTTS for car and PT for cyclists, but still quite similar, which gives more credibility to my estimates.

status and *exercise* as these variables were highly insignificant. I initially thought that *education* would be significant, but surprisingly this attribute were unable to produce the expected results. Though I did not include *travel purpose,* I still cover the most important travel purposes by including the commuting variables, *from work* and *to work*. My data investigation showed that it is highly likely that a cyclist is employed, which might be a reason why *employment status* was highly insignificant, which made me decide not to include the variable in the parameterization. I was also surprised when the coefficients related to *exercise* turned out to be highly insignificant as I initially thought people would exercise less because they cycle. The result might be due to a high number of missing variables. There might be more variables that could produce variations in the VTTS than those included in my models, but there were limited, relevant variables in my dataset, and by running through the initial estimations I am convinced that I found the most important variables available.

The variables left after the initial estimations, are parameterized and estimated with a mixed logit model. As recommended by Train (2009:138) I parameterized cost with income, as it is common to assume that income only affects the marginal utility of money, not time (Börjesson, 2009:34). This results in an independent cost-coefficient for every income interval in the parameterized models. The other variables are parameterized in the time-coefficient for cycle. The result is presented as the MMNL3-model in Table 7:3. To test whether a smaller parameterization provides me with an equal goodness of fit, I chose to estimate the reduced MMNL2-model where the least significant variables in the MMNL3-model were excluded. The excluded variables were *to work, from work, speed fast, speed slow, bad weather, good weather and week or weekend.*

7.2.4 TESTING THE PARAMETERIZED MODELS

Extending the parameterization will not necessarily increase the explanatory power of the model, and it can easily be tested whether one model has more explanatory power than another by performing a *likelihood ratio test* (McFadden and Train, 2000). The likelihood ratio over the two likelihood functions is:

$$\Lambda = \frac{lik_{H_0}(\beta_0 \mid x)}{lik_{H_1}(\beta_1 \mid x)} \tag{7.1}$$

and expresses a ratio of explanatory power. Thus H_1 supposes that the explanatory power increases by extending the parameterization, i.e., that MMNL3 has more explanatory power than MMNL2, while H_0 supposes the opposite. Λ can be tested against the critical value D, specified as

$$D = -2\log\Lambda = -2[\log lik_{H_0}(\beta_0 \mid x) - \log lik_{H_1}(\beta_1 \mid x)] = -2[L_{H_0}(\beta_0 \mid x) - L_{H_1}(\beta_1 \mid x)] \quad (7.2)$$

which is asymptotically χ^2 distributed. $L_{H_0}(\beta_0 \mid x)$ denotes the likelihood of the restricted model while $L_{H_1}(\beta_1 \mid x)$ denotes the likelihood of the unrestricted model.

Table 7:3 summarize the results of the log-likelihood tests. The generalized likelihood ratio is found by inserting the final log-likelihood ratios in D. The critical value is 15.51, which is based on 5% significance and 8 degrees of freedom, as MMNL2 estimates 29 parameters and MMNL3 estimates 37 parameters in all cases. The general likelihood ratio of the total sample is 19.54,[37] which proves the alternative hypothesis to be true, that adding more variables to the model provides a better goodness of fit. The log-likelihood ratio tests also show that the MMNL3-model has more explanatory power for the urban and rural segments, but not for the male and female segments.

Table 7:3: Likelihood ratio test

	Total	Urban	Rural	Male	Female
MMNL2	-6621.449	-2520.095	-4342.890	-3587.291	-2985.541
MMNL3	-6611.679	-2511.006	-4334.718	-3580.969	-2985.181
Generalized likelihood ratio	19.54	18.178	16.344	12.644	0.72
Critical value (see note)	15.51	15.51	15.51	15.51	15.51
Does the extended model increase the goodness of fit?	Yes	Yes	Yes	No	No

Note: The test statistic is χ^2 distributed with 5 % significance and 8 degrees of freedom

7.2.5 VARIATION IN VTTS IN THE TOTAL SAMPLE

In Table 7:4 I present the basic mixed logit model (MMNL1) and the parameterized mixed logit model (MMNL3), for the total sample. The likelihood ratio test proved the MMNL3 model to be the most appropriate for parameterization.

Table 7:4 shows that most of the variables in the MMNL3-model are significant at 1% or 5%. This applies to the time- and cost-coefficients, which are the most important coefficients in any VTTS-study, since they are the main components in the VTTS. Other coefficients that are significant are the income parameterised coefficients, the coefficients stating different reasons to cycle (such as environment and exercise), coefficients for the sample of people over 50 years, coefficients for respondents cycling to work or in bad weather (i.e. snow, rain) in their

[37] $D=-2(-6621.449-(-6611.679))=19.54$

reference journey, as well as the coefficients stating whether the trip was uncomfortable or unacceptable. Some coefficients were significant at only 10 %, which I do not choose to include in the measurement of variation in VTTS. This applies to the coefficient for respondents choosing cycle because they see it as a flexible mode of transport, and for the coefficients for cyclists with many stops in their reference journey.

Coefficients that did not turn out significant in the model were few. The coefficients for respondents that cycle in weekends, cycle from work or with low speed on their reference trip, did not turn out significant.

Table 7:4: Mixed multinomial logit models (MMNL)

MODEL	MMNL1	MMNL3
ASC_car	0.611*** [0.242]	-0.118 [0.237]
ASC_cycle	2.94*** [0.226]	1.59*** [0.223]
ASC_pt	(fixed)	(fixed)
B_cost	-0.0658*** [0.00413]	-0.0980*** [0.00632]
B_cost_inc_high		0.0480*** [0.00944]
B_cost_inc_medium_high		0.0532*** [0.00776]
B_cost_inc_medium_low		0.0407*** [0.00860]
B_cost_inc_low		0.0473*** [0.00976]
B_cost_inc_verylow		(fixed)
B_cycVEG_ingen_CYC	(fixed)	(fixed)
B_cycVEG_meste_CYC	2.13*** [0.0832]	2.13*** [0.0819]
B_time_car	-0.0975*** [0.00971]	-0.103*** [0.00924]
B_time_cyc	-0.178*** [0.00529]	-0.181*** [0.0136]
B_time_pt	-0.0830*** [0.0116]	-0.0718*** [0.0116]
B_time_age_young		(fixed)
B_time_age_old		0.0128*** [0.00349]
B_time_reason_environment		0.0674*** [0.0134]
B_time_reason_exercise		0.0860*** [0.0121]
B_time_reason_flexibility		0.0228* [0.0128]
B_time_reason_other		(fixed)
B_time_speed_fast		(fixed)
B_time_speed_slow		-0.000921 [0.00410]
B_time_towork		0.00864** [0.00359]
B_time_fromwork		-0.00985 [0.00915]
B_time_stop_per_km_few		(fixed)
B_time_stop_per_km_many		-0.00703* [0.00477]
B_time_unacceptable_distance		-0.0333*** [0.00401]
B_time_uncomfortable_distance		-0.0169*** [0.00362]
B_time_weather_bad		0.0113*** [0.00463]
B_time_weather_good		(fixed)

B_time_week		(fixed)
B_time_weekend		-0.00332
		[0.00470]
SIGMA	3.16	1.03
	[1.80e+308]	[0.0712]
Error1	(fixed)	(fixed)
Error2	(fixed)	(fixed)
Error3	(fixed)	(fixed)
Error1_s	-0.514	1.01***
	[0.0453]	[0.169]
Error2_s	-0.481***	1.60***
	[0.0525]	[0.117]
Error3_s	0.220***	0.125***
	[0.184]	[0.143]
missing_age		0.00
		[0.0719]
missing_cost		0.0438***
		[0.0130]
missing_reason		0.0298***
		[0.0113]
missing_speed		0.00
		[0.0464]
missing_stop_per_km		0.00
		[0.0357]
missing_weather		0.00243
		[0.00243]
missing_weekweekend		-0.0278*
		[0.0154]
sigma_time_car	0.0351	0.0272**
	[0.0349]	[0.0125]
sigma_time_cyc	0.0518***	-0.0503***
	[0.00328]	[0.00255]
sigma_time_pt	-0.00899	-0.0147
	[0.0207]	[0.0248]
Adjusted ρ^2	0.389	0.411
Final log-likelihood	-6891.490	-6611.679
N	16295	16295

*Note: Values of estimated coefficient are presented with robust standard errors in brackets. Significance at the 1, 5, and 10 percentage levels are indicated by ***, ** and *, respectively.*

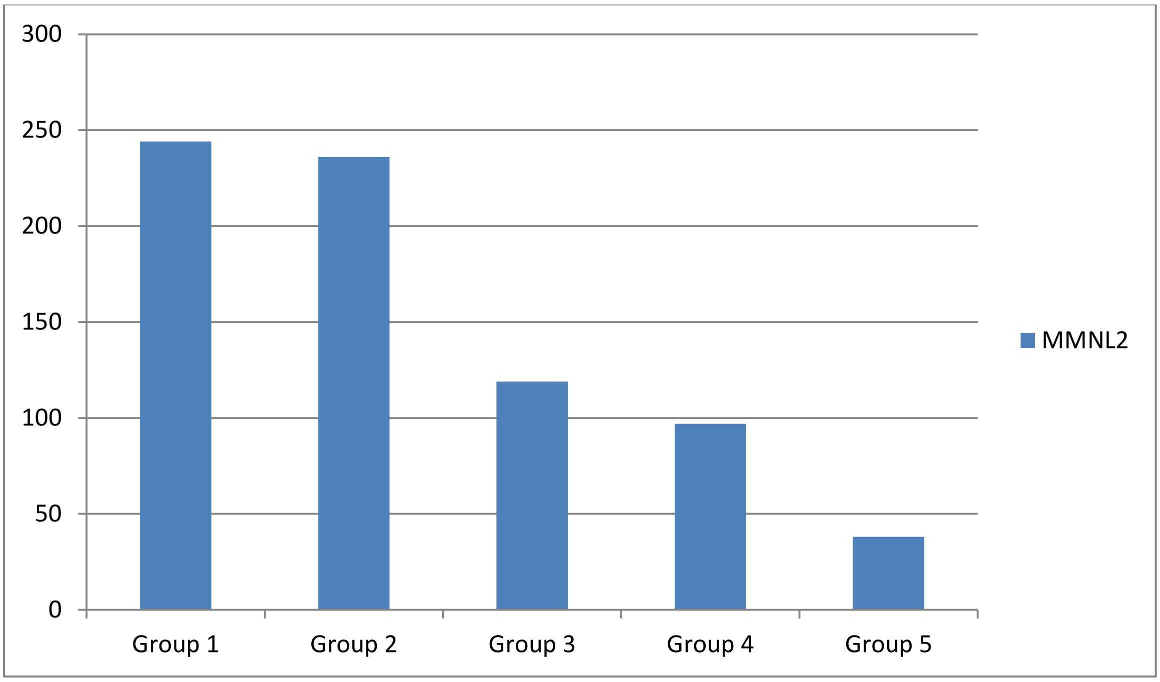
Table 7:5 Groups of cyclists with characteristics

Group	1	2	3	4	5
Attributes					
Income	High	Medium high	Medium Low	Low	Very low
Reason to cycle	Other	Flexible	Environment	Exercise	Exercise
Age	Young	Old	Young	Old	Young
Stops per km	Many	Few	Many	Many	Few
Distance	Unacceptable	Uncomfortable	-	-	-
Weather	Bad	Good	Good	Good	Bad
Week/Weekend	Week	Week	Week	Weekend	Week
Purpose	-	To work	From work	-	To work

This study measure the variation in VTTS among cyclists by grouping the cyclists in five different groups, with characteristics presented in Table 7:5. Based on theory, the group characteristics are pre-composed to measure a higher VTTS in group 1, and lower VTTS for group 5. Group 1 is expected to have the highest VTTS, because it contains cyclists with the highest income and the most adverse comfort characteristics (such as many stops, bad weather and unacceptable distance). Group 2 has less adverse comfort characteristics and lower income than group 1, and so it continues until group 5. The groups could obviously have had another mix of characteristics, but I find the current mix credible for the purpose of illustrating the variation in VTTS among cyclists and journeys. I also find the mix of characteristics within each group credible to characterise different type of cyclists.

Figure 7:1 shows the variation in VTTS based on the different groups of cyclists in Table 7:5. The figure shows that VTTS for group 1 and 2 is almost similar, with a VTTS of 244 NOK/hr for group 1 and 236 NOK/hr for group 2. Group 3 and 4 have a VTTS of 119 NOK/hr and 97 NOK/h, respectively. Group 5 has the lowest value with a VTTS of 38 NOK/h. Figure 7:1 shows that the difference in VTTS is more than 200 NOK/hr between the highest and lowest VTTS-value. This means that there are large differences in VTTS among cyclist. Secondly it shows the pre-assumed decrease in VTTS to be right.

Figure 7:1: VTTS for different groups of cyclists



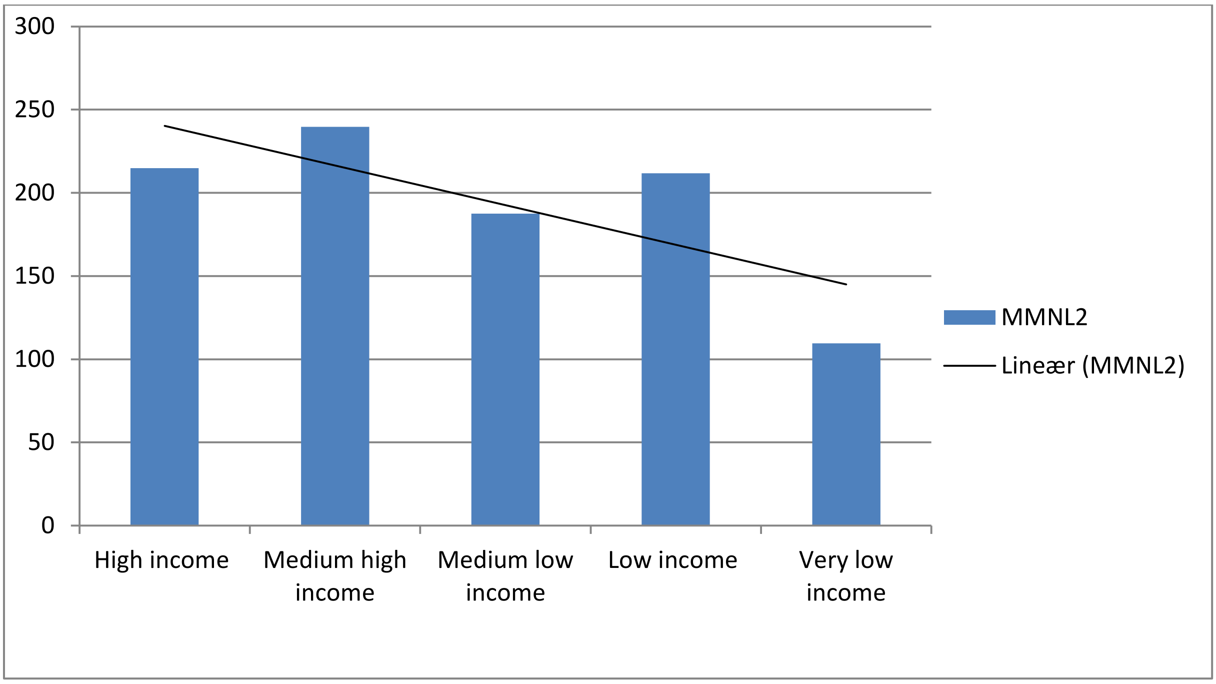
Note: Calculation of VTTS-values can be found in appendix III

The figure shows large variation in VTTS between cyclists, but which coefficients produce the most variation? I find the coefficients related to different reasons to cycle produces the biggest differences in VTTS. For the three latter groups *exercise* reduces the VTTS by up to 100 NOK/hr and *environmental* reason reduces the VTTS of group 3 by almost 60 NOK/hr. These are high and surprising numbers, and shows that variables related to *reason to cycle* accounts for an important part of the variation in VTTS for Norwegian cyclists.[38]

[38] Since highly educated, employed people who see exercise as an important reason to cycle are overrepresented among cyclists there is reason to believe that these characteristics are particular for *current* cyclists. Following

Group 2, 4 and 5 is defined to consist of *old* cyclists. Table 7:4 shows the coefficient for old people to be significant and positive, which lowers the marginal utility of time for these groups. This means that young people has a higher VTTS than old people, which might seem reasonable, as people over 50 usually are less time constrained.

Figure 7:2: VTTS for various income levels in the total sample (ceteris paribus)



Other VTTS-studies show that marginal utility of money tend to decrease in income (Börjesson and Eliasson, 2012; Börjesson, 2009; Small, 2012). Figure 7:2 shows that this is also the case for my sample of cyclists, indicated by the black trend line. The columns show that the high income level has almost 100 NOK/hr higher VTTS than the very low income level.[39] This produces a higher VTTS for the richer income levels, and lower VTTS values for lower income levels, ceteris paribus. For the richer income levels, cyclists have a higher alternative cost of not working, which produces a higher VTTS, because they weight time, more than cost. For lower income levels cost becomes a more prominent attribute and they will more frequently choose a slower transport mode because it is cheaper.

this line of reasoning it is likely that new cyclists have other preferences, like a lower urge to exercise, since they are not among the current cyclists. Since exercise in particular reduces the VTTS by large amounts there is reason to believe that *new* cyclists have higher VTTS. In this case VTTS values for *current* cyclists are downward biased due to self-selection, which makes investments in new infrastructure less profitable. Future research should try to identify the *new* cyclists to see if this is the case. Since I assume *new* cyclists to be equal to *current* cyclists I avoid this complication.

[39] A more negative denominator (produces by a higher marginal utility of money) will produce a smaller VTTS.

7.2.6 VARIATION IN VTTS IN THE REGIONAL AND URBAN SEGMENTS

The study estimates the mixed logit models on the rural and urban parts of the data material. The log-likelihood test in Table 7:3 showed the MMNL3 model to be the most appropriate in this case.

Looking at the ASC for cycle in all models it is clear that the parameterized model provides a smaller average proportion of unexplained variables. The increase in goodness of fit is also proven by a higher adjusted ρ^2 and final log-likelihood. The model for the urban segments also shows a much better goodness of fit than the models for the rural segments.

By calculating the average VTTS, I find a VTTS of 130 NOK/hr for the urban segment, and 186 NOK/hr for the rural segment. This is surprising as I expected urban cyclists to have a higher VTTS than rural cyclists. The intuition behind my expectation is that cities are more congested and have worse safety conditions, which should lead to a higher VTTS for the urban segment. In addition, urban, Norwegian citizens have on average higher income, which I also thought would apply for the sample of cyclists. What can be the explanation that I got the opposite result?

The reason for a higher VTTS among the rural segment is not obvious, but after investigating the data-material, I find that the rural segment have a higher, average income than the urban segment. The average income of the urban segment is 282915 NOK, which is actually lower than the national average income in 2009/2010 (see Table 6:1). This might be the reason for a lower VTTS in the urban segment. Another reason might be that there are more cycle facilities in the urban areas, which makes the urban segment more used to such facilities, something that gives them a lower VTTS. Yet, another reason might be that the urban cyclists are more experienced cyclists, which means that they have a lower discomfort to cycle, something that leads to lower VTTS. Another explanation can be that the experiment assumes the alternative mode to be faster, [40] which might confuse many urban cyclists, as they are used to cycle as the fastest alternative.

Interestingly the time-coefficient for the MMNL1u is more negative than for the MMNL1r, which should give the urban segment a higher VTTS than the latter, ceteris paribus. But since the cost coefficient is almost half as negative for the MMNL1r this result in a final VTTS that is higher for the rural segment than for the urban. MMNL3u and MMNL3r underline this

[40] This is done to identify the willingness to pay for a faster alternative.

tendency since the MMNL3r presents a less negative marginal utility of money for all income levels. The marginal utility of money for an urban, high level income cyclist is almost three times more negative than for a rural, high income cyclist.

My VTTS-values for the urban and rural segments are examples of differences in local values. The NOU (2012) mentions the possibility to use local, specified VTTS-values in CBA, but Hammer (2013) argues for using national values. My discussion above on difficulties on the calculation of local values confirms Hammer's (2013) suspicion related to the use of local values. However there would be large gains in being able to produce credible, local VTTS-values. Hence it is desirable and should be possible to allow researchers to try and experiment to find more optimal methods that give credible, local VTTS-values.

Table 7:6: Mixed Multinomial Logit models (MMNL) for residence segments

MODEL	MMNL1u	MMNL3u	MMNL1r	MMNL3r
ASC_car	0.767**	-0.0799	0.471	-0.151
	[0.372]	[0.383]	[0.333]	[0.317]
ASC_cycle	3.35***	1.80***	2.77***	1.41***
	[0.319]	[0.325]	[0.331]	[0.308]
ASC_pt	(fixed)	(fixed)	(fixed)	(fixed)
B_cost	-0.0961***	-0.121***	-0.0548***	-0.0868***
	[0.00701]	[0.0102]	[0.00483]	[0.00789]
B_cost_inc_high		0.0332**		0.0549***
		[0.0178]		[0.0109]
B_cost_inc_medium_high		0.0541***		0.0482***
		[0.0133]		[0.00925]
B_cost_inc_medium_low		0.0552***		0.0322***
		[0.0153]		[0.0104]
B_cost_inc_low		0.0271		0.0477***
		[0.0168]		[0.0111]
B_cost_inc_verylow		(fixed)		(fixed)
B_cycVEG_ingen_CYC	(fixed)	(fixed)	(fixed)	(fixed)
B_cycVEG_meste_CYC	2.07***	2.03***	2.23***	2.19***
	[0.131]	[0.127]	[0.106]	[0.106]
B_time_car	-0.131***	-0.132***	-0.0883***	-0.0915***
	[0.0183]	[0.0175]	[0.0108]	[0.0105]
B_time_cyc	-0.209***	-0.205***	-0.170***	-0.169***
	[0.00873]	[0.0220]	[0.00648]	[0.0194]
B_time_pt	-0.0966***	-0.0891***	-0.0744***	-0.0552***
	[0.0172]	[0.0179]	[0.0161]	[0.0162]
B_time_age_young		(fixed)		(fixed)
B_time_age_old		0.0226***		0.0104***
		[0.00616]		[0.00407]
B_time_reason_environment		0.0523**		0.0747***
		[0.0217]		[0.0208]
B_time_reason_exercise		0.0826***		0.0889***
		[0.0188]		[0.0181]
B_time_reason_flexibility		0.0440**		-0.000294
		[0.0193]		[0.0200]
B_time_reason_other		(fixed)		(fixed)
B_speed_fast		(fixed)		(fixed)
B_speed_slow		-0.00344		-0.00170
		[0.00628]		[0.00553]
B_time_stop_per_km_few		(fixed)		(fixed)
B_time_stop_per_km_many		0.00185		-0.0215***
		[0.00716]		[0.00750]
B_towork		0.0150***		0.00498
		[0.00553]		[0.00440]
B_fromwork		-0.0101		-0.0142
		[0.0139]		[0.0143]
B_time_unacceptalbe_distance		-0.0382***		-0.0309***
		[0.00605]		[0.00480]

B_time_uncomf_distance		-0.0149**		-0.0194***
		[0.00651]		[0.00433]
B_time_weather_bad		0.0154***		0.0112*
		[0.00630]		[0.00609]
B_time_weather_good		(fixed)		(fixed)
B_time_week		(fixed)		(fixed)
B_time_weekend		-0.00147		-0.0121**
		[0.00726]		[0.00561]
SIGMA	2.01	1.07***	-0.188***	0.836
	[1.80e+308]	[1.80e+308]	[1.80e+308]	[1.80e+308]
Error1	(fixed)	(fixed)	(fixed)	(fixed)
Error2	(fixed)	(fixed)	(fixed)	(fixed)
Error3	(fixed)	(fixed)	(fixed)	(fixed)
Error1_s	0.536***	0.897	3.27	0.385
	[0.111]	[1.80e+308]	[2.92]	[1.80e+308]
Error2_s	1.07***	1.69	10.8***	2.11
	[0.0270]	[1.80e+308]	[1.16]	[5.31]
Error3_s	0.192***	0.0831	0.363***	-0.194
	[0.0718]	[1.80e+308]	[0.504]	[1.80e+308]
missing_age		0.00		0.00
		[1.80e+308]		[1.80e+308]
missing_cost		0.0441**		0.0431***
		[0.0215]		[0.0142]
missing_reason		0.0229		0.0363**
		[0.0176]		[0.0172]
missing_speed		0.00		0.00
		[2.90e+006]		[1.12e+005]
missing_stop_per_km		0.00		0.00
		[1.87e+006]		[1.80e+308]
missing_weather		-0.0191**		0.0204
		[0.00955]		[0.0218]
missing_weekweekend		-0.0345		-0.0349
		[0.0468]		[0.0299]
sigma_time_car	0.0348*	0.0326	0.0483	0.0191
	[0.0205]	[0.0222]	[0.0140]	[0.0137]
sigma_time_cyc	-0.0567***	-0.0430***	-0.0581***	-0.0520***
	[0.00388]	[0.00366]	[0.00340]	[0.00300]
sigma_time_pt	-0.0601***	-0.0479	0.00323	0.00215
	[0.0159]	[0.0415]	[0.00389]	[0.00743]
Adjusted ρ^2	0.422	0.441	0.374	0.395
Final log-likelihood	-2622.226	-2511.006	-4510.295	-4334.718
N	6575	6575	10423	10423

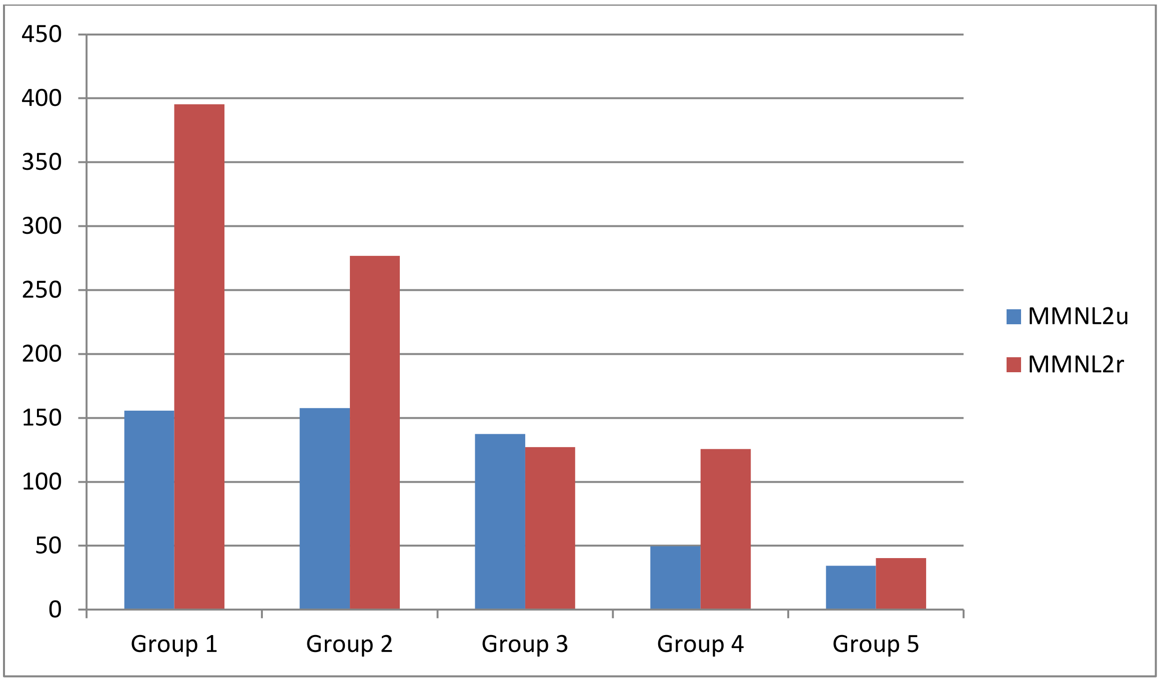
*Note: Values of estimated coefficient are presented with robust standard errors in brackets. Significance at the 1, 5, and 10 percentage levels are indicated by ***, ** and *, respectively.*

Again I calculate the variation in VTTS based on the groups in Table 7:5, with results shown in Figure 7:3. This figure clearly illustrates the large difference in VTTS between urban and rural segments. The two primer groups of the rural segment have almost double VTTS compared to the urban segment. This difference is almost solely due to the less negative cost-coefficient in the rural segment. Interestingly, the rural segment does not have a higher VTTS for the group 3 and 5. This means that the higher income in the rural segment is due to a bigger portion of high income cyclists. The fact that group 4 has a higher VTTS for the rural segment, than urban segment, is because the low income coefficient was not significant for the urban segment, which resulted in a more negative cost-coefficient.[41] The reason might be that there are few respondents in this group, or it might also be that it did not turn out to have any effect. Interestingly group 3 has a higher VTTS for the urban segment than for the rural.

[41] Inserting an artificial variable (such as the medium low income coefficient) for this group gives me almost the same VTTS for the urban segment as group 4 for the rural segment.

The reason is because the coefficient for *environmental reason to cycle* is more positive in the rural segment than in the urban. It might be that the people in rural areas, who live closer to nature, have a higher disutility from not being environmental friendly. Thus, cycling has a higher value from them, and they don not mind to spend more time cycling.

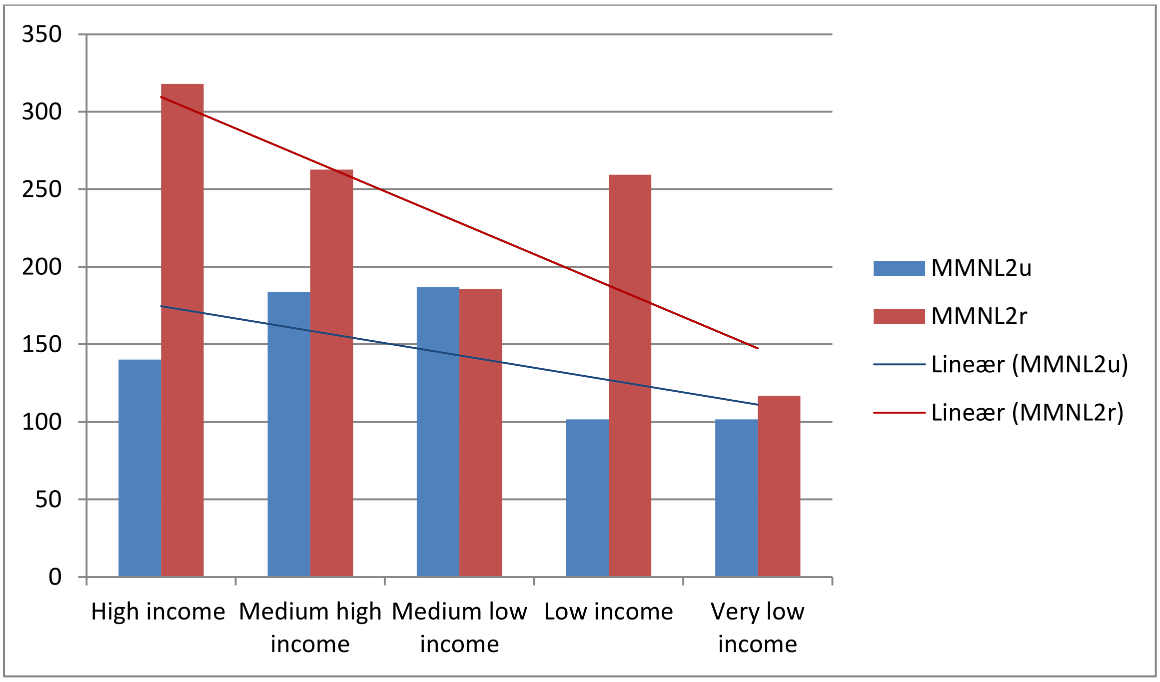
Figure 7:3: VTTS for different groups of cyclists from urban and rural segments



Bad weather is significant at 1 % for the urban segment but only at 10 % for the rural segment. The coefficients for *stop per kilometre* is significant for the rural segment but not for the urban segment. Opposite the coefficient for *cycling to work* is significant for the urban, but not for the rural segment. The coefficient for cycling at weekends is significant for the rural segments, not for the urban segment, and produces a higher VTTS for the primer. This is another puzzling result as one would think that cycling during the week has more time constraints than cycling in weekend, which should lead to a higher VTTS in this case. But in the countryside trip have longer distances than in urban areas, which means that people that commute with cycle during the week have lower VTTS, because there is a higher alternative cost to cycle. This also can be an explanation for a higher VTTS for people that cycle at the weekend.

Figure 7:4 shows that the marginal utility of money is decreasing in income for both segments. The trend line is steeper for the rural segments, which indicates that the decrease in marginal utility of money is stronger in this segment.

Figure 7:4: VTTS for different income levels in the urban and rural segments (ceteris paribus)



7.2.7 VARIATION IN VTTS IN THE GENDER SEGMENTS

In this part the study the mixed logit models is estimated on the male and female segments, presented in Table 7:7. MMNL1f and MMNL1m are the basic mixed logit models, and MMNL2m and MMNL2f are the parameterized mixed logit models, that proved to have higher explanatory in the log-likelihood test in Table 7:3.

Table 7:7: Mixed Multinomial Logit models (MMNL) for gender segments

MODEL	MMNL1m	MMNL2m	MMNL1f	MMNL2f
ASC_car	0.906**	-0.168	0.306	-0.152
	[0.365]	[0.388]	[0.319]	[0.319]
ASC_cycle	3.34***	1.53***	2.58 ***	1.61***
	[0.353]	[0.362]	[0.295]	[0.312]
ASC_pt	(fixed)	(fixed)	(fixed)	(fixed)
B_cost	-0.0683***	-0.116***	-0.0665***	-0.0886***
	[0.00591]	[0.0106]	[0.00572]	[0.00825]
B_cost_inc_high		0.0644***		0.0353**
		[0.0145]		[0.0158]
B_cost_inc_medium_high		0.0718***		0.0397***
		[0.0125]		[0.0107]
B_cost_inc_medium_low		0.0504***		0.0355***
		[0.0141]		[0.0112]
B_cost_inc_low		0.0529***		0.0454***
		[0.0178]		[0.0117]
B_cost_inc_verylow		(fixed)		(fixed)
B_cycVEG_ingen_CYC	(fixed)	(fixed)	(fixed)	(fixed)
B_cycVEG_meste_CYC	1.94***	1.94***	2.39***	2.39***
	[0.116]	[0.114]	[0.121]	[0.122]
B_time_car	-0.118***	-0.122***	-0.0730***	-0.0829***
	[0.0133]	[0.0130]	[0.0135]	[0.0133]
B_time_cyc	-0.189***	-0.177***	-0.174***	-0.188***
	[0.00775]	[0.0221]	[0.00725]	[0.0176]
B_time_pt	-0.108***	-0.0931***	-0.0708***	-0.0601***
	[0.0173]	[0.0177]	[0.0148]	[0.0161]
B_time_age_young		(fixed)		(fixed)
B_time_age_old		0.0172***		0.00716
		[0.00521]		[0.00483]

B_time_reason_environment		0.0592*** [0.0222]		0.0803*** [0.0192]
B_time_reason_exercise		0.0873*** [0.0211]		0.0852*** [0.0151]
B_time_reason_flexibility		0.0172 [0.0224]		0.0214 [0.0158]
B_time_reason_other		(fixed)		(fixed)
B_time_stop_per_km_few		(fixed)		(fixed)
B_time_stop_per_km_many		-0.0159** [0.00760]		-0.00478 [0.00642]
B_time_unacceptable_distance		-0.0332*** [0.00592]		-0.0305*** [0.00517]
B_time_uncomfortable_distance		-0.0258*** [0.00504]		-0.00791 [0.00548]
SIGMA	1.08*** [0.0911]	1.15** [0.495]	-0.528*** [0.0463]	0.847 [1.80e+308]
Error1	(fixed)	(fixed)	(fixed)	(fixed)
Error2	(fixed)	(fixed)	(fixed)	(fixed)
Error3	(fixed)	(fixed)	(fixed)	(fixed)
Error1_s	1.28*** [0.188]	0.735*** [0.266]	-1.82** [0.774]	0.847 [1.80e+308]
Error2_s	0.685*** [0.153]	1.84 [1.80e+308]	2.76*** [0.527]	1.59 [1.80e+308]
Error3_s	0.938*** [0.178]	0.235 [0.260]	-0.156 [0.881]	0.116 [0.670]
missing_age		0.00 [1.80e+308]		
missing_cost		0.0890*** [0.0347]		0.0197*** [0.0143]
missing_reason		0.0258 [0.0200]		0.0383*** [0.0133]
missing_stop_per_km		0.00 [6.50e+003]		
sigma_time_car	0.0511 [0.0504]	0.0344*** [0.0130]	-0.00536 [0.0434]	-0.0211* [0.0129]
sigma_time_cyc	0.0623*** [0.00496]	-0.0575*** [0.00364]	-0.0489*** [0.00438]	-0.0450*** [0.00325]
sigma_time_pt	-0.00313 [0.0246]	-0.0151 [0.0117]	-0.0422 [0.0389]	-0.0373*** [0.0253]
Adjusted ρ^2	0.403	0.428	0.376	0.394
Final log-likelihood	-3757.064	-3587.291	-3088.417	-2985.541
N	9119	9119	7176	7176

*Note: Values of estimated coefficient are presented with robust standard errors in brackets. Significance at the 1, 5, and 10 percentage levels are indicated by ***, ** and *, respectively.*

First, by calculating the average VTTS for these segments I find a VTTS of 166 NOK/hr for males and 157 NOK/hr for females. This shows that males have a slightly higher VTTS than females.

The variations in VTTS for the male and female segments are presented in Figure 7:5. Overall they are similar, with few large deviations. Interestingly males have a higher VTTS than females in group 1 and 2, while females have a higher VTTS than males in group 4 and 5. The reason for the primer is because the coefficients for *many stops per kilometre* and *uncomfortable distance* are significant for males, but not females.[42] The reason why females have higher VTTS in group 4 and 5 is due to a lower marginal utility of money, compared to the male segment, in these levels. The age coefficient is also significant for males, and not females, which produce a lower, relative VTTS for the male segments, ceteris paribus.

[42] Table 7:5 shows us that these characteristics enter in group 1 and 2 respectively.

Figure 7:5: VTTS for different groups of cyclists with gender segmentation

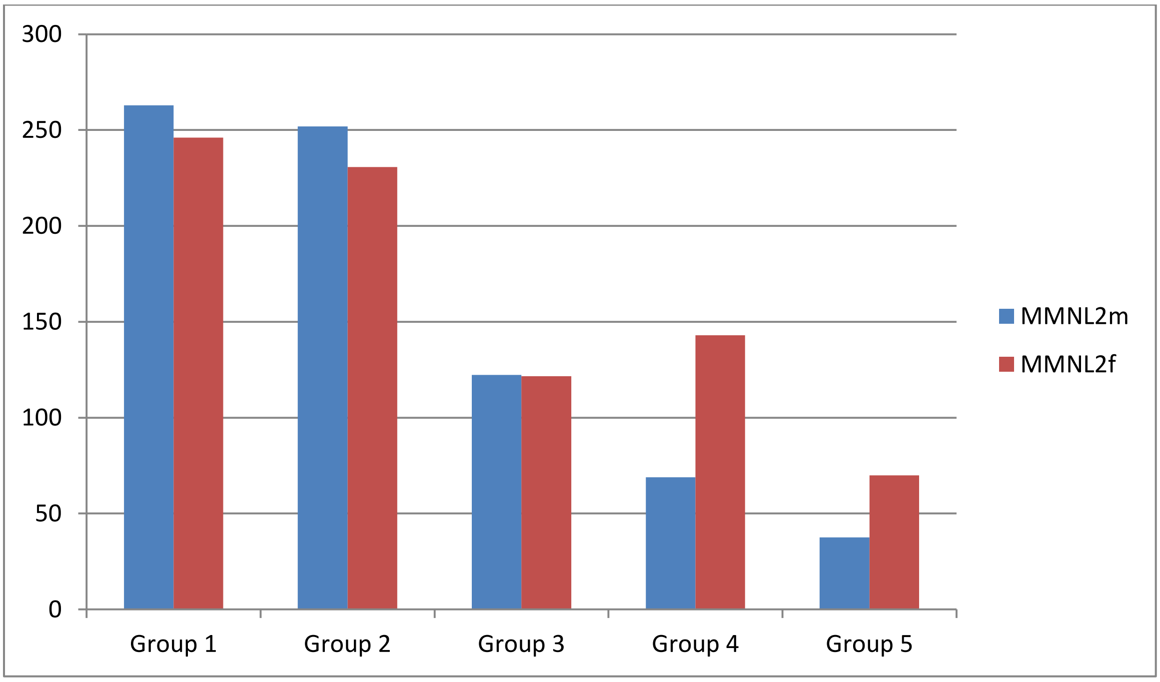


Figure 7:6: VTTS for different income levels in the male and female segments (ceteris paribus)

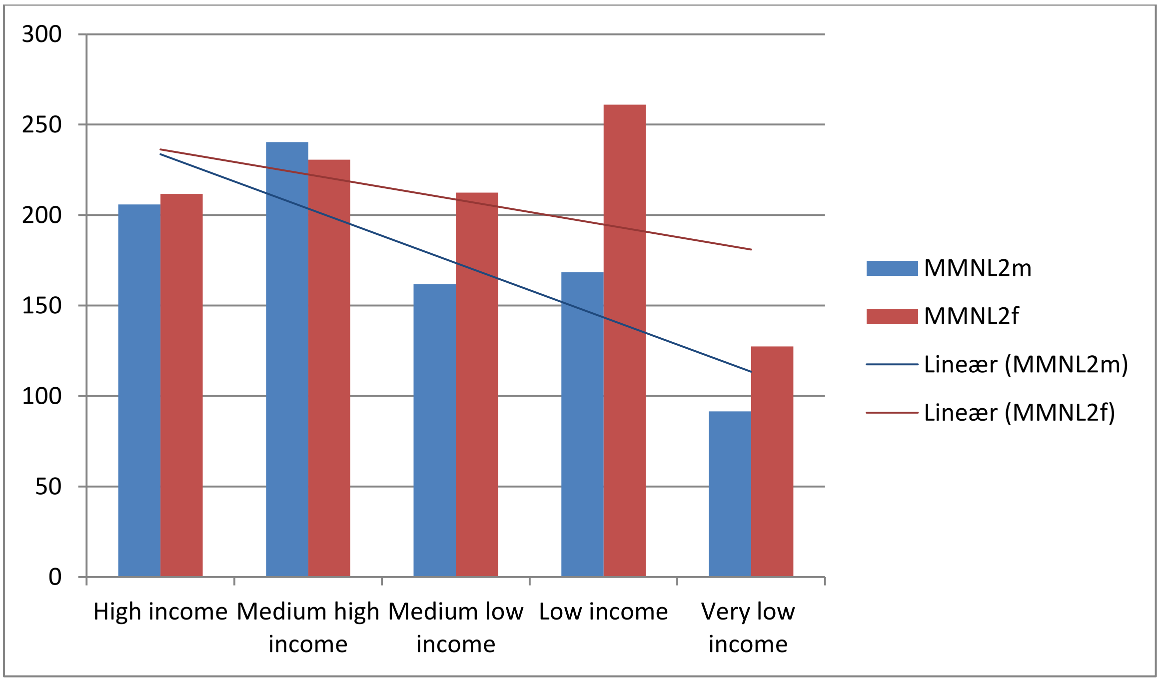
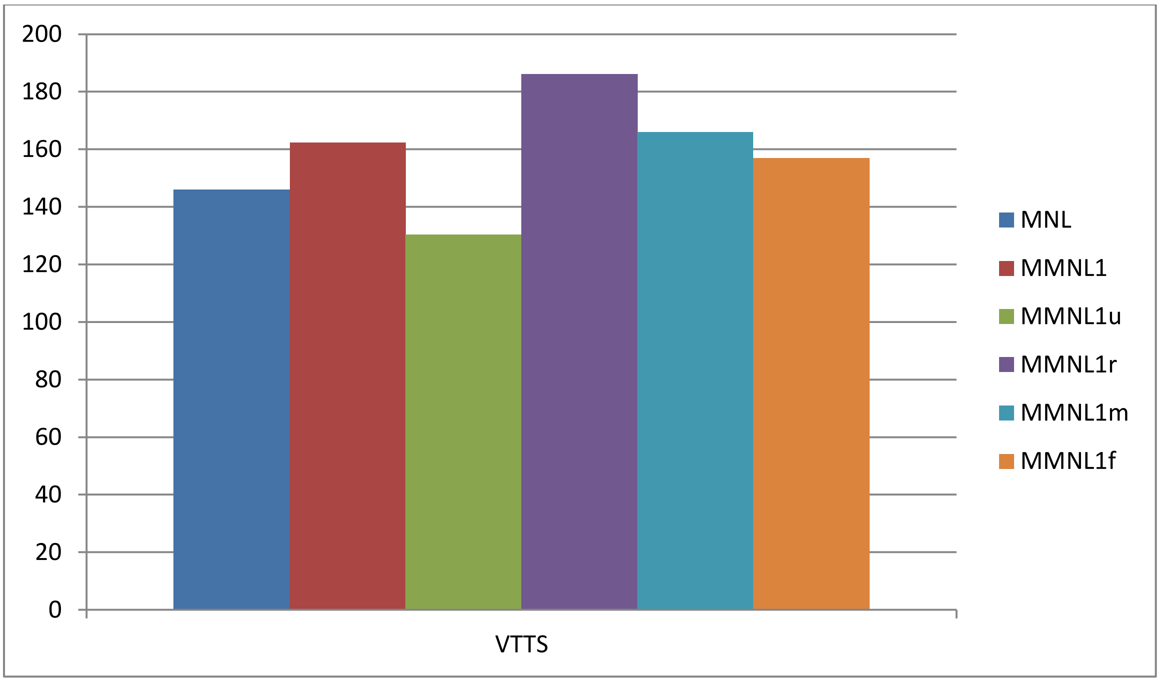


Figure 7:6 shows the decrease in marginal utility of money with income. The trend lines show that the decrease is stronger in the male segment than the female segment. One explanation might be that other variables are better in explaining the variations in VTTS amongst females, such as environmental reasons, a coefficient that is higher for females than males. Figure 7:5 displays how environmental reason decreases VTTS for the female segment in group 3 by almost 90 NOK/h, which is a 40 NOK/hr greater reduction compared to the males segment.

8 DISCUSSION AND CONCLUSION

Figure 8:1 summarizes the average VTTS-values from the previous chapters. Except for the multinomial logit (MNL), these values are based on the mixed logit model, with normal distributed time-coefficients. I find the mixed logit model (MMNL1) to have a better goodness of fit than the MNL with fixed time-coefficients. The VTTS for the total sample is 162 NOK/h, which is in line with Flügel et al. (2013), but higher than the MNL-value and the average value in Ramjerdi et al. (2010b). I conclude that this is most likely due to different model specifications, since these studies utilize more or less the same data. Applying my VTTS-value in national CBAs would make time-saving infrastructure and facilities for cyclists more profitable.

Figure 8:1: Average VTTS for the total sample and segments of cyclists



The rightmost column in Figure 8:1 presents the female segment, with a VTTS of 157 NOK/h, slightly less than the male segment with a VTTS of 166 NOK/hr. On the contrary Börjesson and Eliasson (2012), and Börjesson (2009), found no difference in VTTS between gender. This makes it hard to draw any conclusion, but if the VTTS between genders were not to be equal, it seems that it's more likely to be slightly higher for men than women.

The big difference between the rural and urban segments is most likely due to a higher income in the rural segment. NOU (2012) proposes the use of more local VTTS-values, although results in my study show that there are challenges related to estimating credible local

VTTS-values. Before applying local VTTS-values researchers should conduct more research on appropriate experimental designs and methods for this matter.

I show that marginal utility of money decreases with income for the total sample as well as all segments, which is in line with theory and also shown in other studies (Börjesson and Eliasson, 2012; Börjesson, 2009). This means that VTTS increases in income, ceteris paribus, for all samples. The marginal increase in VTTS with income is highest for the male and rural sample.

In this research I group cyclists with certain attributes, which provides a useful illustration on how VTTS varies over cyclists with different characteristics. The overall picture is that age under 50, higher income, and trips with more adverse comfort factors (e.g., larger distance, more number of stops per kilometres, adverse weather condition, etc.), gives a higher VTTS, which is in line with theory and other studies (Börjesson and Eliasson, 2012; Börjesson, 2009; Flügel et al. (2013); Ramjerdi et al., 2010). My study shows that the variation in VTTS between cyclists with different characteristics is large. Heinen et al., (2010) suggest that more variables, other than socio-economic variables, are relevant in explaining the variations in VTTS for cyclists. The study find that variables related to *reason to cycle* strongly affects the level of VTTS. Especially reason to cycle related to *exercise* and *environment* is significant and reduces VTTS by large amounts.

REFERENCES

Algers, S., P. Bergström, M. Dahlberg and J. L. Dillén (1998): "Mixed Logit Estimation of the Value of Travel Time", Uppsala University: Working paper.

Ben-Akiva M. E. and S. R. Lerman (1985): "Discrete choice analysis: Theory and application to travel demand". Cambridge, Massachusetts: MIT press.

Ben-Akiva, M. E., M. Bierlaire, D. Bolduc and J. Walker (2010): "Discrete Choice Analysis" (book in progress).

Ben-Akiva, M. E. and M. Bierlaire (2010): Lecture notes: "Discrete choice analysis – course 2010". At Ecole Polytechnique Federale de Lausanne (EPFL), Feb 7-11.

Bierlaire, M. (2009): "Estimation of discrete choice models with BIOGEME 1.8", EPEL Transport and Mobility Laboratory, Lausanne, Switzerland. Available at: http://biogeme.epfl.ch/v18/tutorialv18.pdf.

Borger, B. De and M. Fosgerau (2008): "The trade-off between money and travel time: A test of the theory of reference-dependent preferences", *Journal of Urban Economics* 64, 101-115.

Börjesson M. og J. Eliasson (2012): "The value of time and external benefits in bicycle appraisal". *Transportation Research Part A* 46, 673-683.

Börjesson, M. (red.) (2009): "Värdering av tid och bekvämlighet vid cycling", WSP-report 2008:23.

Chirillo, C. and K.W. Axhausen (2006). "Evidence on the distribution of values of travel time savings from a six-week diary", *Transportation Research Part A* 40 (5), 444–457

Flügel, S., F. Ramjerdi, K. Veisten, M. Killi and R. Elvik (2013): "Valuation of cycling facilities with and without controlling for causality risk", *Journal of Sustainable Transportation*, in press.

Fosgerau, M. (2006): "Investigating the distribution of the value of travel time savings", *Transportation Research Part B* 40, 688–707.

Hammer, F. (2013): "Hva koster ett minutt?", *Samferdsel* 2013:5, 19.

Heinen, E., B. van Wee, and K. Maat (2010): “Commuting by bicycle: An overview of the literature”, *Transport Reviews* 30 (1), 59-96.

Hess, S., M. Bierlaire and J. W. Polak (2005): “Estimation of value of travel-time savings using mixed logit models”, *Transportation Research Part A* 39, 221-236.

Jara-Dìaz, S. R. (2000): “Allocation and valuation of travel-time savings”, 303-319. In: Hensher D. and K. Button (red.): *Handbook of transport modelling*. Oxford, UK.

Johnson, M. (1966): “Travel time and the price of leisure”, *Western Economic Journal* 4 (2), 135-145.

Louviere, J. J., D. A. Hensher and J. D. Swait (2000): ”Stated choice methods – analysis and application”. Cambridge: Cambridge university press,.

Luce, R. D. (1959): “Individual Choice Behavior: A Theoretical Analysis”. United States: Dover publications.

Marschak, J. (1960): “Mathematical Methods in the Social Sciences”, United States: Stanford University Press: 312-329

McFadden, D. L. (2000): Nobel Prize lecture: “Economic choices”, Department of Economics, University of California, Berkley, USA.

McFadden, D. L. and K. Train (2000): “Mixed MNL models for discrete choice response”, *Journal of Applied Econometrics* 15, 447-470.

Noland, R. B. and H. Kunreuther (1995): “Short-run and long-run policies for increasing bicycle transportation for daily commuter trips”, Transport Policy 2 (1), 67-79.

Norges Banks (2013), Available at: http://www.norges-bank.no/no/prisstabilitet/valutakurser/

NOU (2012): 16: ”Samfunnsøkonomiske analyser”. Finansdepartementet.

Oort, C. (1969): “The evaluation of travelling time”, *Journal of Transport Economics and Policy* 3, 279-286.

Ramjerdi, F. (1993): “Value of Travel Time Savings: Theories and Empirical Evidences”, TØI- rapport nr. 213.

Ramjerdi, F., S. Flügel, H. Samstad and M. Killi (2010b): “Den norske verdsettingsstudien – tid”, TØI-rapport nr. 1053B.

Ramjerdi, F., S. Flügel, H. Samstad and M. Killi (2010a): “Den norske verdsettingsstudien – databeskrivelse”, TØI-rapport nr. 1053a.

St. Meld. Nr. 26 (2013): ”Nasjonal Transportplan 2014 – 2023”. Samferdselsdepartementet.

Small, K. A. (2012): “Valuation of travel time”. *Economics of Transportation* 1, 2-14.

Stangeby, I. (1997): “Attitudes towards walking and cycling instead of using a car”, TØI-report 1997, 370.

Statistics Norway (2009): ”Statistisk årbok 2009”. Available at: http://www.ssb.no/a/histstat/aarbok/2009.pdf

Statistics Norway (2010): ”Statistisk årbok 2010”. Available at: http://www.ssb.no/a/histstat/aarbok/2010.pdf

Statistics Norway (2011): ”Statistisk årbok 2011”. Available at: http://www.ssb.no/a/histstat/aarbok/2011.pdf

Statistics Norway (2012): ”Statistisk årbok 2012”. Avaiable at : http://www.ssb.no/befolkning/artikler-og-publikasjoner/_attachment/91790?_ts=13c6c86a160

Stock, J. K. and M. M. Watson (2012): “Introduction to econometrics”. England: Pearson Education Limited.

Sælensminde, K. (2002): “Walking- and cycling track networks in Norwegian cities. Cost-benefit analyses including health effects and external costs of road traffic”, TØI-rapport nr. 567.

Train, K. (2009): ”Discrete choice methods with simulation”. Cambridge university press.

Tversky A. and D. Kahneman, (1991): “Loss aversion and riskless choice: A reference-dependent model”, *The Quarterly Journal of Economics* 106 (4), 1039-1061

Wardman, M., M. Tight, and M. Page (1997): “The UK national cycling strategy: can improved facilities meet the targets?” *Transport Policy* 4 (2), 123-133.

APPENDIX I: SUPPLEMENTARY TABLES

Table 0:1: Parameterized Mixed Mulitnomial Logit with normal time-coefficients

MODEL	MMNL2
ASC_car	-0.0903 [0.238]
ASC_cycle	1.63*** [0.224]
ASC_pt	(fixed)
B_cost	-0.0981*** [0.00636]
B_cost_inc_high	0.0478*** [0.00963]
B_cost_inc_medium_high	0.0529*** [0.00783]
B_cost_inc_medium_low	0.0411*** [0.00867]
B_cost_inc_low	0.0482*** [0.00990]
B_cost_inc_verylow	(fixed)
B_cycVEG_ingen_CYC	(fixed)
B_cycVEG_meste_CYC	2.14*** [0.0823]
B_time_car	-0.103*** [0.00921]
B_time_cyc	-0.179*** [0.0133]
B_time_pt	-0.0722*** [0.0117]
B_time_age_young	(fixed)
B_time_age_old	0.0124*** [0.00346]
B_time_reason_environment	0.0693*** [0.0134]
B_time_reason_exercise	0.0877*** [0.0121]
B_time_reason_flexibility	0.0228* [0.0129]
B_time_reason_other	(fixed)
B_time_stop_per_km_few	(fixed)
B_time_stop_per_km_many	-0.00858* [0.00470]
B_time_unacceptable_distance	-0.0324*** [0.00391]
B_time_uncomfortable_distance	-0.0169*** [0.00365]
SIGMA	1.10 [1.80e+308]
Error1	(fixed)
Error2	(fixed)
Error3	(fixed)
Error1_s	0.952 [1.80e+308]
Error2_s	1.50 [1.80e+308]
Error3_s	0.241 [1.32]
missing_age	0.00 [1.80e+308]
missing_cost	0.0441*** [0.0128]
missing_reason	0.0306*** [0.0113]
missing_stop_per_km	0.00 [1.80e+308]
sigma_time_car	0.0272** [0.0125]
sigma_time_cyc	-0.0503*** [0.00255]
sigma_time_pt	-0.0147 [0.0248]

Adjusted ρ^2	0.411
Final log-likelihood	-6621.449
N	16295

*Note: Values of estimated coefficient are presented with robust standard errors in brackets. Significance at the 1, 5, and 10 percentage levels are indicated by ***, ** and *, respectively.*

Table 0:2: Mixed Multinomial Logit with lognormal time-coefficients

MODEL	MMNL1 lognormal	MMNL2 lognormal	MMNL3 lognormal
ASC_car	0.576*** [0.236]	-0.0611 [0.247]	-0.115 [0.250]
ASC_cycle	3.05*** [0.221]	1.63*** [0.233]	1.62*** [0.231]
ASC_pt	(fixed)	(fixed)	(fixed)
B_cost	-0.0652*** [0.00396]	-0.0975*** [0.00657]	-0.0971*** [0.00643]
B_cost_inc_high		0.0495*** [0.00983]	0.0497*** [0.00955]
B_cost_inc_medium_high		0.0521*** [0.00786]	0.0529*** [0.00780]
B_cost_inc_medium_low		0.0410*** [0.00893]	0.0408*** [0.00890]
B_cost_inc_low		0.0488*** [0.00990]	0.0458*** [0.00948]
B_cost_inc_verylow		(fixed)	(fixed)
B_cycVEG_ingen_CYC	(fixed)	(fixed)	(fixed)
B_cycVEG_meste_CYC	2.13*** [0.0814]	2.11*** [0.0815]	2.11*** [0.0807]
B_time_car	-2.37*** [0.116]	-2.33*** [0.0994]	-2.31*** [0.0944]
B_time_cyc	-1.75*** [0.0286]	-1.74*** [0.0690]	-1.74*** [0.0709]
B_time_pt	-2.48*** [0.134]	-2.85*** [0.347]	-2.80*** [0.258]
B_time_age_young		(fixed)	(fixed)
B_time_age_old		0.0126*** [0.00348]	0.0135*** [0.00350]
B_time_reason_environment		0.0689*** [0.0127]	0.0641*** [0.0134]
B_time_reason_exercise		0.0900*** [0.0111]	0.0845*** [0.0110]
B_time_reason_flexibility		0.0306*** [0.0119]	0.0248** [0.0117]
B_time_reason_other		(fixed)	(fixed)
B_time_stop_per_km_few		(fixed)	(fixed)
B_time_stop_per_km_many		-0.0109*** [0.00470]	-0.0101** [0.00480]
B_time_fromwork			-0.0106 [0.0104]
B_time_towork			0.00792** [0.00362]
B_time_speed_fast			(fixed)
B_time_speed_slow			0.000173 [0.00394]
B_time_unacceptable_distance		-0.0316*** [0.00383]	-0.0324*** [0.00385]
B_time_uncomfortable_distance		-0.0167*** [0.00361]	-0.0167*** [0.00363]
B_time_weather_bad			0.0108** [0.00465]
B_time_weather_good			(fixed)
B_time_week			(fixed)
B_time_weekend			-0.00299 [0.00457]
SIGMA	9.18*** [0.337]	12.4 [177.]	0.391 [1.80e+308]
Error1	(fixed)	(fixed)	(fixed)
Error2	(fixed)	(fixed)	(fixed)
Error3	(fixed)	(fixed)	(fixed)
Error1_s	-0.156*** [0.0273]	-0.0910 [1.80e+308]	4.31 [32.3]
Error2_s	-0.188*** [0.0127]	0.112 [0.726]	1.53 [21.0]
Error3_s	-0.0270	0.0289	-3.26

	[0.0202]	[1.80e+308]	[1.80e+308]
missing_age		0.00	0.00
		[7.61e+005]	[1.80e+308]
missing_cost		0.0431***	0.0450***
		[0.0135]	[0.0140]
missing_reason		0.0325***	0.0289***
		[0.0100]	[0.0100]
missing_speed			0.00
			[2.41e+005]
missing_stop_per_km		0.00	0.00
		[1.80e+308]	[2.17e+005]
missing_weather			0.000765
			[0.0102]
missing_weekweekend			-0.0273
			[0.0171]
sigma_time_car	0.189	-0.259***	0.148
	[0.365]	[0.104]	[0.149]
sigma_time_cyc	0.323***	-0.274***	-0.284***
	[0.0142]	[0.0199]	[0.0216]
sigma_time_pt	-0.0249***	-0.646	-0.581**
	[0.0983]	[0.430]	[0.252]
Adjusted ρ^2	0.389	0.409	0.409
Final log-likelihood	-6891.505	-6644.640	-6633.040
N	16295	16295	16295

*Note: Values of estimated coefficient are presented with robust standard errors in brackets. Significance at the 1, 5, and 10 percentage levels are indicated by ***, ** and *, respectively.*

Table 0:3: MMNL models with urban/rural segmentation

MODEL	MMNL2u	MMNL2r
ASC_car	-0.0468	-0.170
	[0.383]	[0.321]
ASC_cycle	1.80***	1.40***
	[0.322]	[0.306]
ASC_pt	(fixed)	(fixed)
B_cost	-0.121***	-0.0872***
	[0.0103]	[0.00784]
B_cost_inc_high	0.0310*	0.0544***
	[0.0170]	[0.0110]
B_cost_inc_medium_high	0.0536***	0.0488***
	[0.0135]	[0.00917]
B_cost_inc_medium_low	0.0536***	0.0334***
	[0.0155]	[0.0104]
B_cost_inc_low	0.0294*	0.0472***
	[0.0171]	[0.0110]
B_cost_inc_verylow	(fixed)	(fixed)
B_cycVEG_ingen_CYC	(fixed)	(fixed)
B_cycVEG_meste_CYC	2.03***	2.19***
	[0.127]	[0.107]
B_time_car	-0.135***	-0.0914***
	[0.0179]	[0.0105]
B_time_cyc	-0.197***	-0.170***
	[0.0206]	[0.0176]
B_time_pt	-0.0892***	-0.0565***
	[0.0176]	[0.0161]
B_time_age_young	(fixed)	(fixed)
B_time_age_old	0.0222***	0.0104***
	[0.00667]	[0.00428]
B_time_reason_environment	0.0490**	0.0770***
	[0.0216]	[0.0183]
B_time_reason_exercise	0.0830***	0.0923***
	[0.0180]	[0.0165]
B_time_reason_flexibility	0.0420**	0.00299
	[0.0180]	[0.0184]
B_time_reason_other	(fixed)	(fixed)
B_time_stop_per_km_few	(fixed)	(fixed)
B_time_stop_per_km_many	-0.00228	-0.0226***
	[0.00665]	[0.00721]
B_time_unacceptalbe_distance	-0.0374***	-0.0297***
	[0.00611]	[0.00483]
B_time_uncomf_distance	-0.0152***	-0.0193***
	[0.00665]	[0.00424]
SIGMA	1.13	0.903
	[20.9]	[17.4]

Error1	(fixed)	(fixed)
Error2	(fixed)	(fixed)
Error3	(fixed)	(fixed)
Error1_s	0.844 [10.6]	0.831 [1.80e+308]
Error2_s	1.58 [1.80e+308]	1.82 [10.3]
Error3_s	-0.0422 [0.615]	-0.350 [1.80e+308]
missing_age	0.00 [1.75e+005]	0.00 [3.33e+005]
missing_cost	0.0467** [0.0220]	0.0424*** [0.0152]
missing_reason	0.0223 [0.0167]	0.0367** [0.0153]
missing_stop_per_km	0.00 [1.06e+005]	0.00 [5.84e+005]
sigma_time_car	0.0357 [0.0232]	0.0215 [0.0252]
sigma_time_cyc	-0.0447*** [0.00438]	-0.0527*** [0.00392]
sigma_time_pt	-0.0499 [0.0395]	0.00159 [0.00909]
Adjusted ρ^2	0.441	0.395
Final log-likelihood	-2520.095	-4342.890
N	6575	10424

*Note: Values of estimated coefficient are presented with robust standard errors in brackets. Significance at the 1, 5, and 10 percentage levels are indicated by ***, ** and *, respectively.*

Table 0:4: MMNL models with gender segmentation

MODEL	MMNL3m	MMNL3f
ASC_car	-0.220 [0.385]	-0.166 [0.327]
ASC_cycle	1.51*** [0.362]	1.56*** [0.305]
ASC_pt	(fixed)	(fixed)
B_cost	-0.116*** [0.0105]	-0.0885*** [0.00813]
B_cost_inc_high	0.0664*** [0.0141]	0.0365** [0.0154]
B_cost_inc_medium_high	0.0714*** [0.0124]	0.0411*** [0.0107]
B_cost_inc_medium_low	0.0494*** [0.0141]	0.0345*** [0.0110]
B_cost_inc_low	0.0527*** [0.0168]	0.0473*** [0.0119]
B_cost_inc_verylow	(fixed)	(fixed)
B_cycVEG_ingen_CYC	(fixed)	(fixed)
B_cycVEG_meste_CYC	1.94*** [0.114]	2.37*** [0.119]
B_time_car	-0.122*** [0.0133]	-0.0801*** [0.0132]
B_time_cyc	-0.181*** [0.0216]	-0.188*** [0.0182]
B_time_pt	-0.0925*** [0.0176]	-0.0603*** [0.0158]
B_time_age_young	(fixed)	(fixed)
B_time_age_old	0.0165 [0.00526]	0.00743 [0.00498]
B_time_fromwork	-0.00256 [0.0187]	-0.0271 [0.0124]
B_time_towork	0.00928 [0.00582]	0.00823* [0.00488]
B_time_reason_environment	0.0550*** [0.0223]	0.0823*** [0.0190]
B_time_reason_exercise	0.0856*** [0.0198]	0.0832*** [0.0158]
B_time_reason_flexibility	0.0167 [0.0207]	0.0221 [0.0167]
B_time_reason_other	(fixed)	(fixed)
B_time_speed_fast	(fixed)	(fixed)
B_time_speed_slow	0.00428	-0.00372

	[0.00587]	[0.00504]
B_time_stop_per_km_few	(fixed)	(fixed)
B_time_stop_per_km_many	-0.0154**	-0.00103
	[0.00693]	[0.00633]
B_time_unacceptable_distance	-0.0339***	-0.0316***
	[0.00599]	[0.00527]
B_time_uncomfortable_distance	-0.0254***	-0.00836*
	[0.00503]	[0.00530]
B_time_weather_bad	0.0140**	0.0111
	[0.00674]	[0.00648]
B_time_weather_good	(fixed)	(fixed)
B_time_week	(fixed)	(fixed)
B_time_weekend	-0.00889	0.00265
	[0.00611]	[0.00634]
SIGMA	1.11**	0.868
	[0.481]	[56.8
Error1	(fixed)	(fixed)
Error2	(fixed)	(fixed)
Error3	(fixed)	(fixed)
Error1_s	0.492	0.915
	[1.80e+308]	[67.6]
Error2_s	1.96	1.36
	[7.37]	[21.9]
Error3_s	0.114	0.538
	[0.546]	[43.6]
missing_age	0.00	0.00
	[1.80e+308]	[1.38e+005
missing_cost	0.0880***	0.0184
	[0.0324]	[0.0138]
missing_reason	0.0324	0.0372***
	[0.0187]	[0.0144]
missing_speed	0.00	0.00
	[1.80e+308]	[5.66e+005]
missing_stop_per_km	0.00	0.00
	[1.80e+308]	[5.12e+005]
missing_weather	-7.44e-005	0.00128
	[0.0186]	[0.0136]
missing_weekweekend	-0.0248	-0.0260
	[0.0216]	[0.0246]
sigma_time_car	0.0312	-0.0229*
	[0.0123]	[0.0101]
sigma_time_cyc	-0.0588***	0.0410***
	[0.00377]	[0.00323]
sigma_time_pt	-0.0120	0.0436***
	[0.00889]	[0.0209]
Adjusted ρ^2	0.428	0.392
Final log-likelihood	-3580.969	-2985.181
N	9119	7176

*Note: Values of estimated coefficient are presented with robust standard errors in brackets. Significance at the 1, 5, and 10 percentage levels are indicated by ***, ** and *, respectively.*

APPENDIX II: DESCRIPTION OF COEFFICIENTS

ASC_car	Alternative specific constant for car
ASC_cycle	Alternative specific constant for cycle
ASC_pt	Alternative specific constant for PT
B_cost	Coefficient (Coef) for cost
B_cost_inc_high	Coef for high income (above 450000 NOK)
B_cost_inc_medium_high	Coef for medium high income (Between 450000NOK and 300000 NOK)
B_cost_inc_medium_low	Coef for medium low income (Between 300000 NOK and 200000 NOK)
B_cost_inc_low	Coef for low income (Between 100000 NOK and 200000 NOK)
B_cost_inc_verylow	Coef for very low income (Under 100000 NOK)
B_time_car	Time coef for car
B_time_cyc	Time coef for cycle
B_time_pt	Time coef for PT
B_time_age_old	Coef for old (age over 50) (don't be offended if you're "old")
B_time_age_young	Coeff for young (age under 50)
B_cycVEG_ingen_CYC	Coef for situation with no cycle path
B_cycVEG_meste_CYC	Coef for situation with cycle path most of the way
B_time_fromwork	Coef for persons that cycled from work in their reference trip
B_time_towork	Coef for persons that cycled to work in their reference trip
B_time_cyclepath_many	Coef for time on cycle path in their reference trip (over half of the way)
B_time_cyclepath_few	Coef for time on cycle path in their reference trip (under half of the way)
B_time_importantreason_environment	Coef for persons with "environment" as reason to choose cycle in the experiment
B_time_importantreason_exercise	Coef for persons with "exercise" as reason to choose cycle in the experiment
B_time_importantreason_flexibility	Coef for persons with "flexibility" as reason to choose cycle in the experiment
B_time_importantreason_other	Coef for persons with "other" as reason to choose cycle in the experiment
B_time_speed_fast	Coef for persons that cycled fast (over 10 km/h) in their reference trip
B_time_speed_slow	Coef for persons that cycled slow (under 10 km/h) in their reference trips
B_time_stop_per_km_many	Coef for persons with many stops (more than 3) per km in their reference trip
B_time_stop_per_km_few	Coef for persons with few stops (less than 3) per km in their reference trip
B_time_uncomfortable_distance	Coef for persons that chose cycle though the time in the experiement exceeded their stated uncomfortable distance to cycle
B_time_unacceptable_distance	Coef for persons that chose cycle though the time in the experiement exceeded their stated unacceptable distance to cycle
B_time_weather_bad	Coef for persons that cycled in bad weather in their reference trip
B_time_weather_good	Coef for persons that cycled in good weather in their reference trip
B_time_week	Coef for persons that cycled in week in their reference trip
B_time_weekend	Coef for persons that cycled in weekend in their reference trip

SIGMA	Standard deviation of the individual specific parameter
error1	Error fixed over alternatives for alt 1
error2	Error fixed over alternatives for alt 2
error3	Error fixed over alternatives for alt 3
error1_s	Error from distribution for alt 1
error2_s	Error from distribution for alt 2
error3_s	Error from distribution for alt 3
missing_age	Coef for missing age value
missing_cost	Coef for missing cost value
missing_cyclepath	Coef for missing cycle path value
missing_reason	Coef for missing reason value
missing_speed	Coef for missing speed value
missing_stop_per_km	Coef for missing stop per km value
missing_weather	Coef for missing weather value
missing_weekweekend	Coef for missing week/weekend value
sigma_time_car	Standard deviation of the time coefficient for car
sigma_time_cyc	Standard deviation of the time coefficient for cycle
sigma_time_pt	Standard deviation of the time coefficient for public transport

APPENDIX III: SOME VTTS CALCULATIONS

Average VTTS based on the MMNL1-model:

$$\frac{\text{B\_time\_cyc}}{\text{B\_cost}} * 60 = \frac{-0.178}{-0.0658} * 60 = 2.705 \, \text{NOK/min} * 60 = 162.3 \approx 162 \, \text{NOK/hr}$$

Same calculation-procedure counts for the other average VTTS estimates, using corresponding values.

VTTS-values for groups of cyclists based on the MMNL3-model:

Group 1:

$$\frac{\text{B\_time\_cyc + B\_time\_unacceptable\_distance + B\_time\_weather\_bad}}{\text{B\_cost + B\_cost\_inc\_high}} * 60 =$$

$$\frac{-0.181 - 0.0333 + 0.0133}{-0.098 + 0.048} * 60 = \frac{-0.203}{-0.05} * 60 = 4.06 \, \text{NOK/min} * 60 =$$

$$243.6 \approx 244 \, \text{NOK/hr}$$

Group 2:

$$\frac{\text{B\_time\_cyc + B\_time\_uncomfortable\_distance + B\_age\_old} + \text{B\_time\_towork}}{\text{B\_cost + B\_cost\_inc\_medium\_high}} * 60 =$$

$$\frac{-0.181 - 0.0169 + 0.0128 + 0.00864}{-0.098 + 0.0532} * 60 = \frac{-0.17646}{-0.0448} * 60 = 3.94 \, \text{NOK/min} * 60 =$$

$$236.4 \approx 236 \, \text{NOK/hr}$$

Group3:

$$\frac{\text{B\_time\_cyc + B\_time\_reason\_environment}}{\text{B\_cost + B\_cost\_inc\_medium\_low}} * 60 =$$

$$\frac{-0.181 + 0.0674}{-0.098 + 0.0407} * 60 = \frac{-0.1136}{-0.0573} * 60 = 1.98 \, \text{NOK/min} * 60 =$$

$$118.8 \approx 119 \, \text{NOK/hr}$$

Group 4:

$$\frac{\text{B\_time\_cyc + B\_age\_old} + \text{B\_time\_reason\_exercise}}{\text{B\_cost + B\_cost\_inc\_low}} * 60 =$$

$$\frac{-0.181 + 0.0128 + 0.086}{-0.098 + 0.0473} * 60 = \frac{-0.0822}{-0.0507} * 60 = 1.62 \text{ NOK/min} * 60 =$$

$$97.2 \approx 97 \text{ NOK/hr}$$

Group 5:

$$\frac{\text{B\_time\_cyc + B\_age\_old} + \text{B\_time\_reason\_exercise} + \text{B\_time\_towork} + \text{B\_time\_weather\_bad}}{\text{B\_cost + B\_cost\_inc\_very\_low}} * 60 =$$

$$\frac{-0.181 + 0.0128 + 0.086 + 0.00864 + 0.0113}{-0.098} * 60 = \frac{-0.06226}{-0.098} * 60 = 0.64 \text{ NOK/min} * 60 =$$

$$38.4 \approx 38 \text{ NOK/hr}$$

Same calculation-procedure counts for the other parameterized VTTS estimates, using corresponding values.

APPENDIX IV: SURVEY (NORWEGIAN ONLY)

The appendix only includes parts of the questionnaire that are utilized in this thesis.

COMMON INTRODUCTORY QUESTIONNAIRE

Vedlegg IV Spørreskjema

Felles innledende spørsmål

Fellestekst1

Til: Deg som respondent
Fra: Samferdselsdepartementet, Statens vegvesen, Jernbaneverket, Avinor, Kystverket, Transportøkonomisk institutt (TØI) og SWECO

For å kunne forbedre transporttilbudet og ta riktige beslutninger knyttet til hvilke samferdselsprosjekter som bør prioriteres i årene framover er det viktig å ha kjennskap til folks verdsetting av transporttilbudene generelt. Vegdirektoratet, Jernbaneverket, Avinor, Kystverket og Samferdselsdepartementet finansierer denne store nasjonale undersøkelsen som nettopp har som formål å kartlegge trafikanters verdsetting av forskjellige forhold ved transporttilbudene, slik som tidsbruk, sikkerhet og miljø. Tilsvarende undersøkelser foregår for tiden også i Sverige og Danmark.

Husk: Det er ingen riktige eller gale svar på spørsmålene i denne undersøkelsen. Det er din mening eller dine anslag som teller. Resultatene fra undersøkelsen vil ikke kunne spores tilbake til deg som enkeltperson.

Vi håper du tar deg tid til å svare på undersøkelsen og på denne måten være med på å legge til rette for en bedre transport- og helsepolitikk i Norge.

Det vil ta ca. 25 minutter å gjennomføre spørreskjemaet. En del av opplysningene hentes opp igjen underveis i skjemaet, og derfor må du besvare undersøkelsen i en og samme sesjon.

Innen kort tid vil det komme en oppfølging av dette spørreskjemaet som vil være noe kortere. Undersøkelsens del 2 fokuserer spesielt på ulykkesrisiko og helse. Vi vil sette stor pris på om du også tar deg tid til å svare på undersøkelsens del 2. Vi takker for din hjelp og ønsker deg lykke til!

P.S: For å være med i trekningen av hovedpremien, må du delta på både del 1 og del 2 av spørreundersøkelsen.

Vennlig hilsen
Samferdselsdepartementet
ved Kjell Rosanoff, avdelingsdirektør
Transportøkonomisk institutt
ved Lasse Fridstrøm, instituttsjef

Neste

Fellestekst2

På de neste sidene vil vi spørre deg om en reise du faktisk har gjennomført nylig.

LES DETTE FØRST: Med "reise" mener vi her "*en forflytning mellom to steder for å utrette et bestemt ærend*", for eksempel dra på jobben, handle, besøke slektninger osv. Alle reiser er like viktige – både lange reiser og kortere turer. Fram- og tilbakereise er to reiser. Om du f.eks. reiser til butikken og handler og siden reiser hjem igjen, har du gjennomført to reiser (en innkjøpsreise og en reise hjem igjen). Har du levert barn i barnehage/skole på vei til arbeidsplassen, har du gjort to reiser (en reise for å levere barnet og en reise til arbeidsplassen).

Neste

Fellestekst3

NB! På grunn av beregninger som gjøres mellom spørsmålene, har du dessverre ikke muligheten til å gå bakover i dette skjemaet.

Klikk "Neste" for å gå videre i skjemaet.

A1

Aller først:

Hvilket år er du født? *(fire sifre)*

A2

Ditt kjønn:

- Mann
- Kvinne

I3

Hvor mange reiser/turer MED SYKKEL (én vei) gjennomførte du forrige uke, hvor sykkel var det eneste transportmiddelet du brukte for å nå fram til bestemmelsesstedet?

Turen må ha tatt mer enn 10 minutter for å telle. Ikke tell med turer der formålet kun var mosjon, rekreasjon eller til/fra en holdeplass. Vennligst skriv "0" dersom du ikke har gjort noen sykkelturer.

Antall turer med sykkel:

Hvis 0: I1. Hvis >0: GS1cycle

GS1cycle

Du foretok alltså minst en reise/tur på sykkel i løpet av siste uke. Vi ønsker at du skal tenke på den lengste av disse reisene (én vei) og svare på spørsmålene nedenfor.

Ikke inkluder reiser som ble gjort kun for mosjon eller til/fra stasjon/holdeplass.

Routes til gang/sykkel-skjema

QUESTIONNAIRE FOR CYCLE AND WALK

19. januar 2010

Spørreskjema for gange og sykling

#transportmiddel # er enten "på sykkel" eller "til fots" som har blitt rutet fra skjema med innledningsspørsmål eller fra reisedagboka i skjema for korte reiser. Turene til fots/på sykkel har følgende kriterier:

- *Er eneste transportmiddel på reisen, dvs at reiser til/fra stasjon/holdeplass ikke er med i den norske tidsverdistudien*
- *Er lenger enn 10 minutter*
- *Ikke er tjenestereiser*

GS1 og GS1A *("På sykkel" erstattes av "til fots" dersom respondenten har gått)*

GS1

Du foretok minst en reise på sykkel i løpet av siste uke. Ikke inkluder reiser som ble gjort kun for mosjon eller til/fra stasjon/holdeplass. Vi ønsker at du skal velge ut den lengste av disse reisene (én vei) og svare på spørsmålene nedenfor.

GS1A

Hva var formålet med reisen?

- Reise til/fra arbeidsplassen
- Reise til/fra skolen
- Innkjøp
- Service (bank, post etc.)
- Besøk hos slekt og venner
- Hente/levere barn
- Andre private ærend (f.eks. dra på trening eller andre fritidsaktiviteter, møter etc.)
- Tjenestereise

Hvis tjenestereise: Går til I4 (spørsmål om de har foretatt en lang reise). Hvis de har foretatt en lang reise går til de skjema for lange reiser, hvis ikke, til skjema for korte reiser.

Hvis andre reiseformål: GS2.

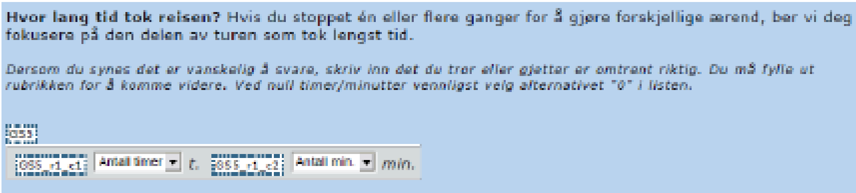
GS2. Hvor startet din reise #transportmiddel#?

- ❑ Eget bosted
- ❑ Egen arbeidsplass/skole
- ❑ Annet sted

GS3. Hvor endte din reise #transportmiddel#?

- ❑ Eget bosted
- ❑ Egen arbeidsplass/skole
- ❑ Annet sted

GS5.



Hvor lang tid tok reisen? Hvis du stoppet én eller flere ganger for å gjøre forskjellige ærend, ber vi deg fokusere på den delen av turen som tok lengst tid.

Dersom du synes det er vanskelig å svare, skriv inn det du tror eller gjetter er omtrent riktig. Du må fylle ut rubrikken for å komme videre. Ved null timer/minutter vennligst velg alternativet "0" i listen.

GS5

GS5_r1_c1 Antall timer *t.* GS5_r1_c2 Antall min. *min.*

GS6.

På hvilket klokkeslett startet reisen?

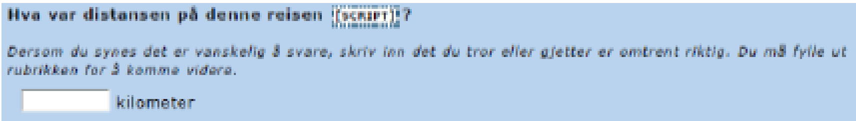
GS6

Angi omtrent klokkeslett GS6_r1_c1 tt GS6_r1_c2 mm

GS6tt

Om du ikke vet/husker vennligst trykk på "Neste".

GS10.



Hva var distansen på denne reisen [SCRIPT] **?**

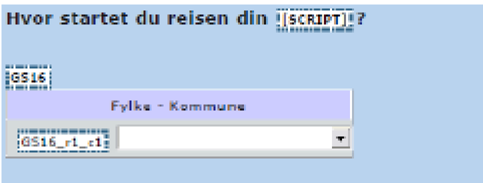
Dersom du synes det er vanskelig å svare, skriv inn det du tror eller gjetter er omtrent riktig. Du må fylle ut rubrikken for å komme videre.

kilometer

GS15. Hvilken ukedag foretok du reisen?

- Søndag/helligdag
- Mandag – torsdag
- Fredag
- Lørdag
- Jeg husker ikke

GS16.



Hvor startet du reisen din [SCRIPT] **?**

GS16

Fylke - Kommune

GS16_r1_c1

Hvis #transportmiddel# er "på sykkel" gå til GS18

Hvis #transportmiddel# er "til fots" gå til GS19

GS18. Hvor stor andel av din sykkelreise foregikk på sykkelsti/sykkelbane adskilt fra biltrafikk?

- ☐ Ingen
- ☐ En mindre del av reisen foregikk på sykkelsti/bane
- ☐ Cirka halve reisen foregikk på sykkelsti/bane
- ☐ En større del av reisen foregikk på sykkelsti/bane
- ☐ Hele

Gå til GS20

GS19. Hvor stor andel av din spasertur foregikk på gangveg/fortau adskilt fra biltrafikk?

- ☐ Ingen
- ☐ En mindre del av turen foregikk på gangveg/fortau
- ☐ Cirka halve turen foregikk på gangveg/fortau
- ☐ En større del av turen foregikk på gangveg/fortau
- ☐ Hele

Alle:

GS20.

Omtrent hvor mange gate-/vegkryss (med eller uten trafikklys) måtte du krysse på din reise [SCRIPT] ?

Dersom du synes det er vanskelig å svare, skriv inn det du tror eller gjetter er omtrent riktig. Du må fylle ut rubrikken for å komme videre.

Ca. antall gate-/vegkryss: ____

GS20A.

Hvordan var været da du startet den reisen [SCRIPT] som du har beskrevet tidligere?

- ○ Skyfri himmel
- ○ Overskyet – Lett skydekke
- ○ Overskyet – lette regnbyger
- ○ Regnvær
- ○ Sludd
- ○ Snøvær
- ○ Tåke
- ○ Annet, notèr: GS20A_8_other ____
- ○ Husker ikke

GS20B.

Hva var den viktigste grunnen til at du valgte å gå eller sykle?

- ○ Billig
- ○ Mosjon
- ○ Raskt
- ○ Fleksibelt
- ○ Miljøvennlig
- ○ Annet: GS20B_6_other ____

For syklende:

GS39A.

Tenk deg at før du startet din reise, kunne du velge mellom å sykle eller bruke et alternativ transportmiddel. Det alternative transportmiddelet kan være bil eller kollektivtransport. Hvilket hadde passet best for deg av disse to?

- ○ Bil, som fører
- ○ Kollektivtransport
- ○ Ingen av dem

Hvis svar er "Bil, som fører": #ALTtransportmiddel# ="bil". Gå til GS40.

Hvis svar er "Kollektivtransport": #ALTtransportmiddel# ="Kollektivtransport". Gå til GS40.

Hvis svaret er "Ingen av dem". Gå til GS39C.

GS40. CE1: Transportmiddelvalg for syklende (1BMC)

Veger, sykkelstier og sykkelbaner kan legges om og priser gå opp og ned. Det betyr at din reisetid og reisekostnad kunne vært annerledes.

Tenk deg at før du startet din sykkeltur, kunne du ha valgt mellom sykkel og *#ALTtransportmiddel#*. Du vil nå få noen valg mellom to reiser A og B på skjermen. Transportmiddel, reisetid (dør til dør) og reisekostnad varierer.

Du skal velge den reisen du ville foretrekke.

("N/A" er det alternative transportmiddelet.)

Ta utgangspunkt i to alternative reiser. En reise på sykkel og en reise med [SCRIPT]. Hvilken reise foretrekker du?

Reise på sykkel	N/Areise
Reisetid: 0 min.	**Reisetid:** 0 min.
Sykkelsti/bane: Ingen	**Kostnad:** 0 kr
○	○

Antall valg. Generering av attributtnivåer og -kombinasjoner

Gå til GS40B (Kontrollspørsmål)

GS40E. Hva var den viktigste grunnen til at transportmiddel fikk betydning for dine valg?

- ○ **Miljøhensyn**
- ○ **Mosjon**
- ○ **Fleksibilitet**
- ○ **Annet: ____________________**

GS40F. Hva var den viktigste grunnen til at reisetid fikk betydning for dine valg?

- ○ **Reisetida var for lang til å gå/sykle**
- ○ **Reisetida var passelig til å gå/sykle**
- ○ **Annet: ____________________**

Common final questionnaire

19. januar 2010

Felles avsluttende spørsmål

tA3

Vi er imponert over din utholdenhet! Du skal vite at dine svar er av stor betydning for samferdselsmyndighetene. Helt til slutt trenger vi noen bakgrunnsopplysninger til bruk i den statistiske analysen av resultatene. Vi minner om at alle svar behandles konfidensielt og at ingen svar vil kunne kobles tilbake til deg i etterkant.

A3

Hvor mange barn og voksne, fordelt på alder, bor det i husholdningen din, inkludert deg selv?

Antall barn 0-6 år	A3_r1_c1	Antall barn
Antall barn 7-12 år	A3_r2_c1	Antall barn
Antall barn 13-17 år	A3_r3_c1	Antall barn
Antall voksne 18 – 67 år	A3_r4_c1	Antall voksne
Antall voksne over 67 år	A3_r5_c1	Antall voksne

A4

Hva er din høyeste allmennutdannelse?

- Grunnskole (folkeskole/barneskole og eventuell ungdomsskole)
- Videregående skole (3 år utover grunnskole)
- Høgskole/universitetsutdannelse (inntil 4 år etter videregående)
- Universitetsutdannelse (mer enn 4 års utdannelse etter videregående)

A5

Hva er din hovedsaklige sysselsetting?

- Inntektsbringende arbeid
- Eget foretak
- Elev, student
- Hjemmearbeidende
- Arbeidsledig, på tiltak
- Pensjonist, trygdet
- Foreldrepermisjon
- Vernepliktig
- Annet

A6

"Script" er sum basert på svar i A3

Hvor mange av de [SCRIPT] personene i husholdningen din som er over 18 år vil du si er yrkesaktive (som hovedgjøremål)?

- Ingen
- 1 person
- 2 personer
- 3 eller flere personer

A7

Er du yrkesaktiv på heltid eller deltid?

- Heltid (35 timer pr. uke eller mer)
- Deltid (under 35 timer pr. uke, men over 20 timer pr. uke)
- Deltid (20 timer eller mindre pr. uke)
- Arbeider ikke

A12

Hvor stor er husholdningens årsinntekt før skatt?

Med inntekt menes lønn, pensjon, studielån, erstatning fra forsikringsselskap, inntekt av eget foretak elle jordbruk.

- Under 200 000 kr/år
- 200 001-400 000 kr/år
- 400 001-600 000 kr/år
- 600 001-800 000 kr/år
- 800 001-1 000 000 kr/år
- 1 000 001 – 1 200 000 kr/år
- 1 200 001 – 1 400 000 kr/år
- Over 1 400 000 kr/år
- Vet ikke
- Ønsker ikke å svare

A14

Hvilken kommune bor du i?

A14

Fylke - Kommune
A14_r1_c1

A16

Vi vil nå gi deg noen spørsmål knyttet til hvor ofte du sykler eller går, **i stedet for å bruke bil eller offentlige transportmidler,** for å komme til en aktivitet. Vi er her ikke interessert i sykling eller gange som er knyttet til mosjon/rekreasjon.

Har du i løpet av det siste året syklet eller gått
- til/fra arbeid/skole,
- i forbindelse med legebesøk, innkjøpsreise eller lignende,
- for å besøke familie/venner, eller til ulike arrangementer, eller
- i forbindelse med annen reise (ikke sykkelturer og turgåing som kun er for mosjon/rekreasjon)?

- Ja
- Nei

Hvis ja: A17A. Hvis nei: A18A.

A17A

Hvor ofte har du i løpet av de siste 7 dagene syklet/gått i forbindelse med den typen reiseformål som det ble spurt om i foregående spørsmål?

Ikke regn med sykkelturer og turgåing som kun er for mosjon/rekreasjon.

A17A

Syklet:	A17A_r1_c1	ganger (i løpet av en uke)
Gått:	A17A_r2_c1	ganger (i løpet av en uke)

A17B

Hvor mye tid brukte du i gjennomsnitt per dag til sykling/gange i forbindelse med den typen reiseformål som det ble spurt om i foregående spørsmål?

Ikke regn med sykkelturer og turgåing som kun er for mosjon/rekreasjon.

Regn kun med sykling/gange av minst 10 minutters varighet.

A17B

	Column 1
Sykling:	A17B_r1_c1 [ ] min. per dag
Gange:	A17B_r2_c1 [ ] min. per dag

A18

Det at du sykler/går som framkomstmiddel, har det noe å bety for den tiden du bruker til fysisk aktivitet (idrett/trening/mosjon) totalt?

- Bruker alt i alt mindre tid på fysisk aktivitet enn det jeg ville gjort uten sykling/gange
- Nei, bruker omtrent samme tid på fysisk aktivitet totalt, selv om jeg sykler/går som framkomstmiddel
- Bruker alt i alt mer tid på fysisk aktivitet enn det jeg ville gjort uten sykling/gange
- Vet ikke

A18A

Tenk deg at du syklet/gikk som framkomstmiddel. Ville det hatt noe å bety for den tiden du brukte på fysisk aktivitet totalt?

- Ville alt i alt brukt mindre tid på fysisk aktivitet enn det jeg ville gjort uten sykling/gange
- Nei, ville brukt omtrent samme tid på fysisk aktivitet totalt, selv om jeg syklet/gikk som framkomstmiddel
- Ville alt i alt brukt mer tid på fysisk aktivitet enn det jeg ville gjort uten sykling/gange
- Vet ikke
- Uaktuelt, jeg ville uansett aldri syklet/gått som framkomstmiddel

A19

Vi vil sette pris på å få dine kommentarer på dette spørreskjemaet. Kommentarer kan skrives i boksen nedenfor.

Felles slutt

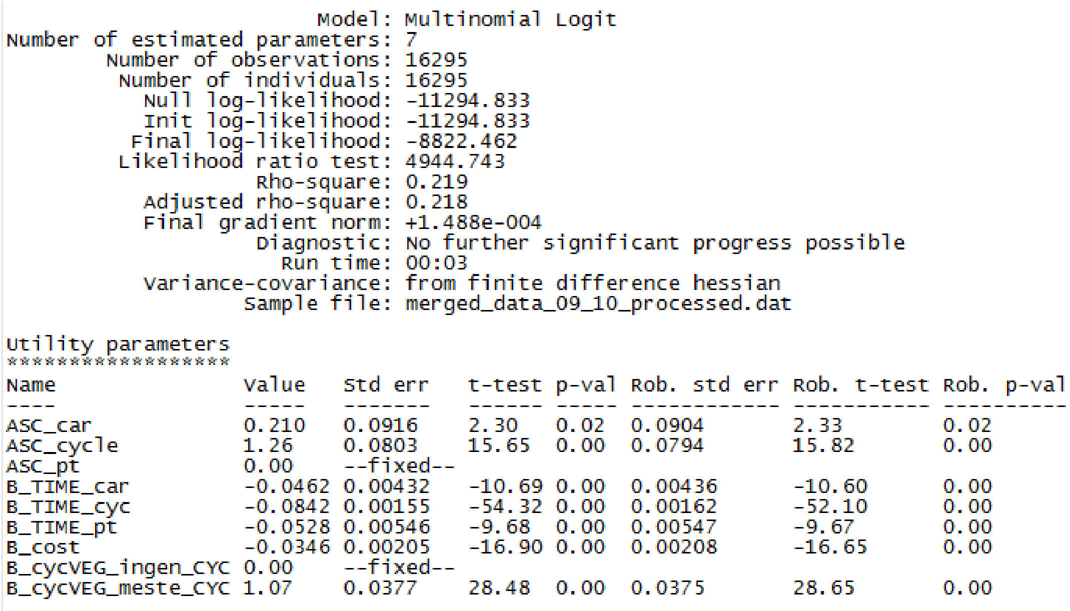
Tusen takk for din deltakelse så langt!

Du er nå ferdig med den første, store delen av undersøkelsen, og er med i trekningen av fire reisegavekort på kr 5000 og to reisegavekort på kr 10 000.

Den siste delen av undersøkelsen sendes ut om noen dager. Den er ikke like lang, og der kan du bli spurt om sikkerhet og miljø knyttet til transport.

APPENDIX V: BIOGEME REPORT FILES

Figure 0:1: MNL



```
                     Model: Multinomial Logit
Number of estimated parameters: 7
       Number of observations: 16295
        Number of individuals: 16295
          Null log-likelihood: -11294.833
          Init log-likelihood: -11294.833
         Final log-likelihood: -8822.462
        Likelihood ratio test: 4944.743
                   Rho-square: 0.219
          Adjusted rho-square: 0.218
          Final gradient norm: +1.488e-004
                   Diagnostic: No further significant progress possible
                     Run time: 00:03
          Variance-covariance: from finite difference hessian
                  Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                Value   Std err   t-test p-val Rob. std err Rob. t-test Rob. p-val
----                -----   -------   ------ ----- ------------ ----------- ----------
ASC_car             0.210   0.0916    2.30   0.02  0.0904       2.33        0.02
ASC_cycle           1.26    0.0803    15.65  0.00  0.0794       15.82       0.00
ASC_pt              0.00    --fixed--
B_TIME_car          -0.0462 0.00432   -10.69 0.00  0.00436      -10.60      0.00
B_TIME_cyc          -0.0842 0.00155   -54.32 0.00  0.00162      -52.10      0.00
B_TIME_pt           -0.0528 0.00546   -9.68  0.00  0.00547      -9.67       0.00
B_cost              -0.0346 0.00205   -16.90 0.00  0.00208      -16.65      0.00
B_cycVEG_ingen_CYC  0.00    --fixed--
B_cycVEG_meste_CYC  1.07    0.0377    28.48  0.00  0.0375       28.65       0.00
```

Figure 0:2: MMNL1

```
                 Model:  Mixed Multinomial Logit for panel data
       Number of Halton draws: 500
Number of estimated parameters: 14
       Number of observations: 16296
        Number of individuals: 2037
          Null log-likelihood: -11294.833
          Init log-likelihood: -10263.442
         Final log-likelihood: -6891.490
        Likelihood ratio test: 8806.686
                   Rho-square: 0.390
          Adjusted rho-square: 0.389
          Final gradient norm: +4.390e-007
                   Diagnostic: Convergence reached
                     Run time: 04h 49:15
          Variance-covariance: from finite difference hessian
                  Sample file: merged_data_09_10_processed.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
ASC_car	0.611	0.228	2.68	0.01		0.242	2.53	0.01	
ASC_cycle	2.94	0.202	14.55	0.00		0.226	12.99	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.0658	0.00357	-18.43	0.00		0.00413	-15.93	0.00	
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	2.13	0.0661	32.29	0.00		0.0832	25.63	0.00	
B_time_car	-0.0975	0.00876	-11.12	0.00		0.00971	-10.04	0.00	
B_time_cyc	-0.178	0.00418	-42.60	0.00		0.00529	-33.65	0.00	
B_time_pt	-0.0830	0.0111	-7.51	0.00		0.0116	-7.16	0.00	
SIGMA	3.16	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error1	0.00	--fixed--							
error1_s	-0.514	1.80e+308	-0.00	1.00	*	0.0453	-11.34	0.00	
error2	0.00	--fixed--							
error2_s	-0.481	1.80e+308	-0.00	1.00	*	0.0525	-9.15	0.00	
error3	0.00	--fixed--							
error3_s	0.220	1.80e+308	0.00	1.00	*	0.184	1.20	0.23	*
sigma_time_car	0.0351	0.0247	1.42	0.16	*	0.0349	1.01	0.31	*
sigma_time_cyc	0.0518	0.00269	19.27	0.00		0.00328	15.80	0.00	
sigma_time_pt	-0.00899	0.0244	-0.37	0.71	*	0.0207	-0.43	0.66	*

Figure 0:3: MMNL2

```
                 Model:  Mixed Multinomial Logit for panel data
       Number of Halton draws: 700
Number of estimated parameters: 29
       Number of observations: 16296
        Number of individuals: 2037
          Null log-likelihood: -11294.833
          Init log-likelihood: -10262.399
         Final log-likelihood: -6621.449
        Likelihood ratio test: 9346.769
                   Rho-square: 0.414
          Adjusted rho-square: 0.411
          Final gradient norm: +3.880e-005
                   Diagnostic: No further significant progress possible
                     Run time: 17h 31:56
          Variance-covariance: from finite difference hessian
                  Sample file: merged_data_09_10_processed.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
ASC_car	-0.0903	0.232	-0.39	0.70	*	0.238	-0.38	0.70	*
ASC_cycle	1.63	0.207	7.86	0.00		0.224	7.26	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.0981	0.00559	-17.55	0.00		0.00636	-15.41	0.00	
B_cost_inc_high	0.0478	0.00919	5.20	0.00		0.00963	4.97	0.00	
B_cost_inc_low	0.0482	0.00910	5.30	0.00		0.00990	4.87	0.00	
B_cost_inc_medium_high	0.0529	0.00716	7.39	0.00		0.00783	6.76	0.00	
B_cost_inc_medium_low	0.0411	0.00800	5.14	0.00		0.00867	4.75	0.00	
B_cost_inc_verylow	0.00	--fixed--							
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	2.14	0.0661	32.32	0.00		0.0823	25.95	0.00	
B_time_age_old	0.0124	0.00343	3.62	0.00		0.00346	3.59	0.00	
B_time_age_young	0.00	--fixed--							
B_time_car	-0.103	0.00834	-12.31	0.00		0.00921	-11.15	0.00	
B_time_cyc	-0.179	0.0108	-16.54	0.00		0.0133	-13.43	0.00	
B_time_importantreason_environment	0.0693	0.0122	5.66	0.00		0.0134	5.17	0.00	
B_time_importantreason_exercise	0.0877	0.0100	8.75	0.00		0.0121	7.25	0.00	
B_time_importantreason_flexibility	0.0228	0.0106	2.16	0.03		0.0129	1.77	0.08	*
B_time_importantreason_other	0.00	--fixed--							
B_time_pt	-0.0722	0.0112	-6.43	0.00		0.0117	-6.18	0.00	
B_time_stop_per_km_few	0.00	--fixed--							
B_time_stop_per_km_many	-0.00858	0.00494	-1.74	0.08	*	0.00470	-1.82	0.07	*
B_time_unacceptable_distance	-0.0324	0.00277	-11.70	0.00		0.00391	-8.28	0.00	
B_time_uncomfortable_distance	-0.0169	0.00292	-5.79	0.00		0.00365	-4.64	0.00	
SIGMA	1.10	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error1	0.00	--fixed--							
error1_s	0.952	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error2	0.00	--fixed--							
error2_s	1.50	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error3	0.00	--fixed--							
error3_s	0.241	1.80e+308	0.00	1.00	*	1.32	0.18	0.85	*
missing_age	0.00	3.41e+006	0.00	1.00	*	1.80e+308	0.00	1.00	*
missing_cost	0.0441	0.0133	3.32	0.00		0.0128	3.45	0.00	
missing_importantreason	0.0306	0.00924	3.31	0.00		0.0113	2.70	0.01	
missing_stop_per_km	0.00	5.86e+006	0.00	1.00	*	1.80e+308	0.00	1.00	*
sigma_time_car	0.0272	0.0156	1.75	0.08	*	0.0125	2.19	0.03	
sigma_time_cyc	-0.0503	0.00245	-20.56	0.00		0.00255	-19.77	0.00	
sigma_time_pt	-0.0147	0.0306	-0.48	0.63	*	0.0248	-0.59	0.55	*

Figure 0:4: MMNL3

```
                     Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 700
Number of estimated parameters: 37
        Number of observations: 9119
         Number of individuals: 1140
           Null log-likelihood: -6320.809
           Init log-likelihood: -5575.827
          Final log-likelihood: -3580.969
         Likelihood ratio test: 5479.681
                    Rho-square: 0.433
           Adjusted rho-square: 0.428
           Final gradient norm: +3.768e-005
                    Diagnostic: No further significant progress possible
                      Run time: 12h 39:50
           Variance-covariance: from finite difference hessian
                   Sample file: merged_data_09_10_processed.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
ASC_car	-0.220	0.375	-0.59	0.56	*	0.385	-0.57	0.57	*
ASC_cycle	1.51	0.342	4.42	0.00		0.362	4.18	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.116	0.00926	-12.57	0.00		0.0105	-11.14	0.00	
B_cost_inc_high	0.0664	0.0130	5.11	0.00		0.0141	4.69	0.00	
B_cost_inc_low	0.0527	0.0149	3.53	0.00		0.0168	3.14	0.00	
B_cost_inc_medium_high	0.0714	0.0109	6.55	0.00		0.0124	5.76	0.00	
B_cost_inc_medium_low	0.0494	0.0125	3.96	0.00		0.0141	3.49	0.00	
B_cost_inc_verylow	0.00	--fixed--							
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	1.94	0.0906	21.42	0.00		0.114	16.99	0.00	
B_time_age_old	0.0165	0.00509	3.23	0.00		0.00526	3.13	0.00	
B_time_age_young	0.00	--fixed--							
B_time_car	-0.122	0.0117	-10.40	0.00		0.0133	-9.19	0.00	
B_time_cyc	-0.181	0.0169	-10.67	0.00		0.0216	-8.37	0.00	
B_time_fromwork	-0.00256	0.0186	-0.14	0.89	*	0.0187	-0.14	0.89	*
B_time_importantreason_environment	0.0550	0.0195	2.81	0.00		0.0223	2.47	0.01	
B_time_importantreason_exercise	0.0856	0.0156	5.48	0.00		0.0198	4.32	0.00	
B_time_importantreason_flexibility	0.0167	0.0162	1.03	0.30	*	0.0207	0.81	0.42	*
B_time_importantreason_other	0.00	--fixed--							
B_time_pt	-0.0925	0.0181	-5.10	0.00		0.0176	-5.26	0.00	
B_time_speed_fast	0.00	--fixed--							
B_time_speed_slow	0.00428	0.00621	0.69	0.49	*	0.00587	0.73	0.47	*
B_time_stop_per_km_few	0.00	--fixed--							
B_time_stop_per_km_many	-0.0154	0.00755	-2.03	0.04		0.00693	-2.22	0.03	
B_time_towork	0.00928	0.00554	1.68	0.09	*	0.00582	1.59	0.11	*
B_time_unacceptable_distance	-0.0339	0.00408	-8.30	0.00		0.00599	-5.65	0.00	
B_time_uncomfortable_distance	-0.0254	0.00428	-5.94	0.00		0.00503	-5.05	0.00	
B_time_weather_bad	0.0140	0.00717	1.95	0.05	*	0.00674	2.08	0.04	
B_time_weather_good	0.00	--fixed--							
B_time_week	0.00	--fixed--							
B_time_weekend	-0.00889	0.00654	-1.36	0.17	*	0.00611	-1.45	0.15	*
SIGMA	1.11	1.80e+308	0.00	1.00	*	0.481	2.32	0.02	
error1	0.00	--fixed--							
error1_s	0.492	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error2	0.00	--fixed--							
error2_s	1.96	1.80e+308	0.00	1.00	*	7.37	0.27	0.79	*
error3	0.00	--fixed--							
error3_s	0.114	1.80e+308	0.00	1.00	*	0.546	0.21	0.83	*
missing_age	0.00	1.79e+006	0.00	1.00	*	1.80e+308	0.00	1.00	*
missing_cost	0.0880	0.0272	3.24	0.00		0.0324	2.72	0.01	
missing_importantreason	0.0251	0.0145	1.73	0.08	*	0.0187	1.34	0.18	*
missing_speed	0.00	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
missing_stop_per_km	0.00	1.50e+006	0.00	1.00	*	1.80e+308	0.00	1.00	*
missing_weather	-7.44e-005	0.0169	-0.00	1.00	*	0.0186	-0.00	1.00	*
missing_weekweekend	-0.0248	0.0267	-0.93	0.35	*	0.0216	-1.15	0.25	*

Figure 0:5: MMNL1 lognormal

```
                    Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 500
Number of estimated parameters: 14
        Number of observations: 16296
         Number of individuals: 2037
           Null log-likelihood: -11294.833
           Init log-likelihood: -116511.101
          Final log-likelihood: -6891.505
         Likelihood ratio test: 8806.656
                    Rho-square: 0.390
           Adjusted rho-square: 0.389
           Final gradient norm: +2.254e-007
                    Diagnostic: Convergence reached
                      Run time: 12h 57:13
           Variance-covariance: from finite difference hessian
                   Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                Value   Std err   t-test p-val    Rob. std err Rob. t-test Rob. p-val
----                -----   -------   ------ -----    ------------ ----------- ----------
ASC_car             0.576   0.226     2.54   0.01     0.236        2.44        0.01
ASC_cycle           3.05    0.202     15.09  0.00     0.221        13.75       0.00
ASC_pt              0.00    --fixed--
B_cost              -0.0652 0.00350   -18.62 0.00     0.00396      -16.45      0.00
B_cycVEG_ingen_CYC  0.00    --fixed--
B_cycVEG_meste_CYC  2.13    0.0655    32.57  0.00     0.0814       26.20       0.00
B_time_car          -2.37   0.102     -23.18 0.00     0.116        -20.46      0.00
B_time_cyc          -1.75   0.0230    -76.15 0.00     0.0286       -61.26      0.00
B_time_pt           -2.48   0.131     -18.92 0.00     0.134        -18.55      0.00
SIGMA               9.18    1.80e+308 0.00   1.00   * 0.337        27.24       0.00
error1              0.00    --fixed--
error1_s            -0.156  1.80e+308 -0.00  1.00   * 0.0273       -5.74       0.00
error2              0.00    --fixed--
error2_s            -0.188  1.80e+308 -0.00  1.00   * 0.0127       -14.75      0.00
error3              0.00    --fixed--
error3_s            -0.0270 1.80e+308 -0.00  1.00   * 0.0202       -1.34       0.18        *
sigma_time_car      0.189   0.305     0.62   0.54   * 0.365        0.52        0.60        *
sigma_time_cyc      0.323   0.0147    22.05  0.00     0.0142       22.77       0.00
sigma_time_pt       -0.0249 0.240     -0.10  0.92   * 0.0983       -0.25       0.80        *

Variance of normal random coefficients
**************************************
Name                        Value     Std err t-test
----                        -----     ------- ------
B_time_car_sigma_time_car   4.36e+005 0.115   3782975.64
B_time_cyc_sigma_time_cyc   3.61e+004 0.00949 3806319.48
B_time_pt_sigma_time_pt     1.64e+007 0.0119  1378508803.25
error1_error1_s             8.32e+006 nan     nan
error2_error2_s             3.12e+007 nan     nan
error3_error3_s             2.58e+003 nan     nan
```

Figure 0:6: MMNL2 lognormal

```
                    Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 500
Number of estimated parameters: 29
        Number of observations: 16296
         Number of individuals: 2037
           Null log-likelihood: -11294.833
           Init log-likelihood: -104355.167
          Final log-likelihood: -6644.640
         Likelihood ratio test: 9300.387
                    Rho-square: 0.412
           Adjusted rho-square: 0.409
           Final gradient norm: +1.387e-005
                    Diagnostic: No further significant progress possible
                      Run time: 3 days 23h 13:38
           Variance-covariance: from finite difference hessian
                   Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                                 Value   Std err   t-test p-val    Rob. std err Rob. t-test Rob. p-val
----                                 -----   -------   ------ -----    ------------ ----------- ----------
ASC_car                              -0.0611 0.234     -0.26  0.79   * 0.247        -0.25       0.80        *
ASC_cycle                            1.63    0.209     7.83   0.00     0.233        7.02        0.00
ASC_pt                               0.00    --fixed--
B_cost                               -0.0975 0.00565   -17.27 0.00     0.00657      -14.85      0.00
B_cost_inc_high                      0.0495  0.00932   5.31   0.00     0.00983      5.04        0.00
B_cost_inc_low                       0.0488  0.00913   5.34   0.00     0.00990      4.93        0.00
B_cost_inc_medium_high               0.0521  0.00715   7.28   0.00     0.00786      6.63        0.00
B_cost_inc_medium_low                0.0410  0.00804   5.10   0.00     0.00893      4.60        0.00
B_cost_inc_verylow                   0.00    --fixed--
B_cycVEG_ingen_CYC                   0.00    --fixed--
B_cycVEG_meste_CYC                   2.11    0.0654    32.36  0.00     0.0815       25.96       0.00
B_time_age_old                       0.0126  0.00333   3.78   0.00     0.00348      3.61        0.00
B_time_age_young                     0.00    --fixed--
B_time_car                           -2.33   0.0917    -25.42 0.00     0.0994       -23.45      0.00
B_time_cyc                           -1.74   0.0571    -30.48 0.00     0.0690       -25.22      0.00
B_time_importantreason_environment   0.0689  0.0118    5.84   0.00     0.0127       5.41        0.00
B_time_importantreason_exercise      0.0900  0.00932   9.66   0.00     0.0111       8.13        0.00
B_time_importantreason_flexibility   0.0306  0.00959   3.19   0.00     0.0119       2.57        0.01
B_time_importantreason_other         0.00    --fixed--
B_time_pt                            -2.85   0.266     -10.73 0.00     0.347        -8.22       0.00
B_time_stop_per_km_few               0.00    --fixed--
B_time_stop_per_km_many              -0.0109 0.00474   -2.31  0.02     0.00470      -2.33       0.02
B_time_unacceptable_distance         -0.0316 0.00267   -11.82 0.00     0.00383      -8.25       0.00
B_time_uncomfortable_distance        -0.0167 0.00289   -5.78  0.00     0.00361      -4.62       0.00
SIGMA                                12.4    1.80e+308 0.00   1.00   * 177.         0.07        0.94        *
error1                               0.00    --fixed--
error1_s                             -0.0910 1.80e+308 -0.00  1.00   * 1.80e+308    -0.00       1.00        *
error2                               0.00    --fixed--
error2_s                             0.112   1.80e+308 0.00   1.00   * 0.726        0.15        0.88        *
error3                               0.00    --fixed--
error3_s                             0.0289  1.80e+308 0.00   1.00   * 1.80e+308    0.00        1.00        *
missing_age                          0.00    8.00e+006 0.00   1.00   * 7.61e+005    0.00        1.00        *
missing_cost                         0.0431  0.0133    3.24   0.00     0.0135       3.19        0.00
missing_importantreason              0.0325  0.00833   3.90   0.00     0.0100       3.24        0.00
missing_stop_per_km                  0.00    1.80e+308 0.00   1.00   * 1.80e+308    0.00        1.00        *
sigma_time_car                       -0.259  0.143     -1.81  0.07   * 0.104        -2.48       0.01
sigma_time_cyc                       -0.274  0.0189    -14.54 0.00     0.0199       -13.76      0.00
```

Figure 0:7: MMNL3 lognormal

```
                Model:  Mixed Multinomial Logit for panel data
   Number of Halton draws: 500
Number of estimated parameters: 37
   Number of observations: 16295
    Number of individuals: 2037
      Null log-likelihood: -11294.833
      Init log-likelihood: -116511.101
     Final log-likelihood: -6633.040
    Likelihood ratio test: 9323.587
               Rho-square: 0.413
      Adjusted rho-square: 0.409
      Final gradient norm: +3.772e-008
               Diagnostic: Convergence reached
                 Run time: 3 days 06h 50:22
      Variance-covariance: from finite difference hessian
              Sample file: merged_data_09_10_processed.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
ASC_car	-0.115	0.235	-0.49	0.62	*	0.250	-0.46	0.64	*
ASC_cycle	1.62	0.208	7.80	0.00		0.231	7.01	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.0971	0.00561	-17.31	0.00		0.00643	-15.11	0.00	
B_cost_inc_high	0.0497	0.00921	5.40	0.00		0.00955	5.21	0.00	
B_cost_inc_low	0.0458	0.00889	5.15	0.00		0.00948	4.84	0.00	
B_cost_inc_medium_high	0.0529	0.00714	7.42	0.00		0.00780	6.79	0.00	
B_cost_inc_medium_low	0.0408	0.00803	5.07	0.00		0.00890	4.58	0.00	
B_cost_inc_verylow	0.00	--fixed--							
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	2.11	0.0651	32.46	0.00		0.0807	26.17	0.00	
B_time_age_old	0.0135	0.00333	4.06	0.00		0.00350	3.87	0.00	
B_time_age_young	0.00	--fixed--							
B_time_car	-2.31	0.0860	-26.88	0.00		0.0944	-24.48	0.00	
B_time_cyc	-1.74	0.0567	-30.72	0.00		0.0709	-24.55	0.00	
B_time_fromwork	-0.0106	0.0111	-0.95	0.34	*	0.0104	-1.02	0.31	*
B_time_importantreason_environment	0.0641	0.0119	5.39	0.00		0.0134	4.78	0.00	
B_time_importantreason_exercise	0.0845	0.00896	9.43	0.00		0.0110	7.69	0.00	
B_time_importantreason_flexibility	0.0248	0.00917	2.70	0.01		0.0117	2.11	0.03	
B_time_importantreason_other	0.00	--fixed--							
B_time_pt	-2.80	0.241	-11.62	0.00		0.258	-10.88	0.00	
B_time_speed_fast	0.00	--fixed--							
B_time_speed_slow	0.000173	0.00386	0.04	0.96	*	0.00394	0.04	0.96	*
B_time_stop_per_km_few	0.00	--fixed--							
B_time_stop_per_km_many	-0.0101	0.00489	-2.06	0.04		0.00480	-2.10	0.04	
B_time_towork	0.00792	0.00353	2.24	0.02		0.00362	2.19	0.03	
B_time_unacceptable_distance	-0.0324	0.00266	-12.17	0.00		0.00385	-8.40	0.00	
B_time_uncomfortable_distance	-0.0167	0.00290	-5.78	0.00		0.00363	-4.62	0.00	
B_time_weather_bad	0.0108	0.00478	2.25	0.02		0.00465	2.32	0.02	
B_time_weather_good	0.00	--fixed--							
B_time_week	0.00	--fixed--							
B_time_weekend	-0.00299	0.00430	-0.69	0.49	*	0.00457	-0.65	0.51	*
SIGMA	0.391	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error1	0.00	--fixed--							
error1_s	4.31	1.80e+308	0.00	1.00	*	32.3	0.13	0.89	*
error2	0.00	--fixed--							
error2_s	1.53	1.80e+308	0.00	1.00	*	21.0	0.07	0.94	*
error3	0.00	--fixed--							
error3_s	-3.26	1.80e+308	-0.00	1.00	*	1.80e+308	-0.00	1.00	*
missing_age	0.00	6.14e+006	0.00	1.00	*	1.80e+308	0.00	1.00	*
missing_cost	0.0450	0.0138	3.27	0.00		0.0140	3.22	0.00	
missing_importantreason	0.0289	0.00792	3.65	0.00		0.0100	2.88	0.00	
missing_speed	0.00	2.43e+006	0.00	1.00	*	2.41e+005	0.00	1.00	*
missing_stop_per_km	0.00	1.80e+308	0.00	1.00	*	2.17e+005	0.00	1.00	*
missing_weather	0.000765	0.00978	0.08	0.94	*	0.0102	0.07	0.94	*
missing_weekweekend	-0.0273	0.0176	-1.55	0.12	*	0.0171	-1.59	0.11	*

Figure 0:8: MML1f

```
                     Model:  Mixed Multinomial Logit for panel data
       Number of Halton draws: 700
Number of estimated parameters: 14
       Number of observations: 7176
        Number of individuals: 897
          Null log-likelihood: -4974.024
          Init log-likelihood: -4687.826
         Final log-likelihood: -3088.417
        Likelihood ratio test: 3771.215
                   Rho-square: 0.379
          Adjusted rho-square: 0.376
          Final gradient norm: +2.071e-005
                   Diagnostic: No further significant progress possible
                     Run time: 03h 00:21
          Variance-covariance: from finite difference hessian
                  Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                  Value     Std err    t-test p-val   Rob. std err Rob. t-test Rob. p-val
----                  -----     -------    ------ -----   ------------ ----------- ----------
ASC_car               0.306     0.302      1.01   0.31  * 0.319        0.96        0.34        *
ASC_cycle             2.58      0.263      9.79   0.00    0.295        8.73        0.00
ASC_pt                0.00      --fixed--
B_cost                -0.0665   0.00503    -13.22 0.00    0.00572      -11.62      0.00
B_cycVEG_ingen_CYC    0.00      --fixed--
B_cycVEG_meste_CYC    2.39      0.0986     24.29  0.00    0.121        19.75       0.00
B_time_car            -0.0730   0.0122     -6.00  0.00    0.0135       -5.42       0.00
B_time_cyc            -0.174    0.00592    -29.40 0.00    0.00725      -24.02      0.00
B_time_pt             -0.0708   0.0148     -4.78  0.00    0.0154       -4.59       0.00
SIGMA                 -0.528    1.80e+308  -0.00  1.00  * 0.0463       -11.42      0.00
error1                0.00      --fixed--
error1_s              -1.82     1.80e+308  -0.00  1.00  * 0.774        -2.35       0.02
error2                0.00      --fixed--
error2_s              2.76      1.80e+308  0.00   1.00  * 0.527        5.24        0.00
error3                0.00      --fixed--
error3_s              -0.156    1.80e+308  -0.00  1.00  * 0.881        -0.18       0.86        *
sigma_time_car        -0.00536  0.0452     -0.12  0.91  * 0.0434       -0.12       0.90        *
sigma_time_cyc        -0.0489   0.00363    -13.46 0.00    0.00364      -13.43      0.00
sigma_time_pt         -0.0422   0.0307     -1.38  0.17  * 0.0389       -1.08       0.28        *
```

Figure 0:9: MMNL2f

```
                     Model:  Mixed Multinomial Logit for panel data
       Number of Halton draws: 700
Number of estimated parameters: 29
       Number of observations: 7176
        Number of individuals: 897
          Null log-likelihood: -4974.024
          Init log-likelihood: -4687.826
         Final log-likelihood: -2985.541
        Likelihood ratio test: 3976.967
                   Rho-square: 0.400
          Adjusted rho-square: 0.394
          Final gradient norm: +3.331e-005
                   Diagnostic: No further significant progress possible
                     Run time: 07h 02:07
          Variance-covariance: from finite difference hessian
                  Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                                  Value    Std err   t-test p-val   Rob. std err Rob. t-test Rob. p-val
----                                  -----    -------   ------ -----   ------------ ----------- ----------
ASC_car                               -0.152   0.304     -0.50  0.62  * 0.319        -0.48       0.63        *
ASC_cycle                             1.61     0.273     5.90   0.00    0.312        5.17        0.00
ASC_pt                                0.00     --fixed--
B_cost                                -0.0886  0.00714   -12.41 0.00    0.00825      -10.74      0.00
B_cost_inc_high                       0.0353   0.0158    2.23   0.03    0.0158       2.24        0.03
B_cost_inc_low                        0.0454   0.0111    4.08   0.00    0.0117       3.87        0.00
B_cost_inc_medium_high                0.0397   0.0102    3.91   0.00    0.0107       3.71        0.00
B_cost_inc_medium_low                 0.0355   0.0104    3.43   0.00    0.0112       3.18        0.00
B_cost_inc_verylow                    0.00     --fixed--
B_cycVEG_ingen_CYC                    0.00     --fixed--
B_cycVEG_meste_CYC                    2.39     0.0990    24.16  0.00    0.122        19.66       0.00
B_time_age_old                        0.00716  0.00496   1.45   0.15  * 0.00483      1.48        0.14        *
B_time_age_young                      0.00     --fixed--
B_time_car                            -0.0829  0.0122    -6.81  0.00    0.0133       -6.21       0.00
B_time_cyc                            -0.188   0.0153    -12.31 0.00    0.0176       -10.66      0.00
B_time_importantreason_environment    0.0803   0.0178    4.52   0.00    0.0192       4.19        0.00
B_time_importantreason_exercise       0.0852   0.0140    6.10   0.00    0.0151       5.65        0.00
B_time_importantreason_flexibility    0.0214   0.0146    1.46   0.14  * 0.0158       1.35        0.18        *
B_time_importantreason_other          0.00     --fixed--
B_time_pt                             -0.0601  0.0150    -4.00  0.00    0.0161       -3.74       0.00
B_time_stop_per_km_few                0.00     --fixed--
B_time_stop_per_km_many               -0.00478 0.00663   -0.72  0.47  * 0.00642      -0.74       0.46        *
B_time_unacceptable_distance          -0.0305  0.00384   -7.96  0.00    0.00517      -5.90       0.00
B_time_uncomfortable_distance         -0.00791 0.00420   -1.88  0.06  * 0.00548      -1.44       0.15        *
SIGMA                                 0.847    1.80e+308 0.00   1.00  * 1.80e+308    0.00        1.00        *
error1                                0.00     --fixed--
error1_s                              0.847    1.80e+308 0.00   1.00  * 1.80e+308    0.00        1.00        *
error2                                0.00     --fixed--
error2_s                              1.59     1.80e+308 0.00   1.00  * 1.80e+308    0.00        1.00        *
error3                                0.00     --fixed--
error3_s                              0.116    1.80e+308 0.00   1.00  * 0.670        0.17        0.86        *
missing_age                           0.00     1.80e+308 0.00   1.00  * 1.80e+308    0.00        1.00        *
missing_cost                          0.0197   0.0151    1.30   0.19  * 0.0143       1.37        0.17        *
missing_importantreason               0.0383   0.0126    3.03   0.00    0.0133       2.88        0.00
missing_stop_per_km                   0.00     1.80e+308 0.00   1.00  * 1.80e+308    0.00        1.00        *
sigma_time_car                        -0.0211  0.0206    -1.03  0.31  * 0.0129       -1.64       0.10        *
sigma_time_cyc                        -0.0450  0.00336   -13.40 0.00    0.00325      -13.85      0.00
sigma_time_pt                         -0.0373  0.0256    -1.46  0.14  * 0.0253       -1.47       0.14        *
```

Figure 0:10: MMNL3f

```
                    Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 700
Number of estimated parameters: 37
        Number of observations: 7176
         Number of individuals: 897
           Null log-likelihood: -4974.024
           Init log-likelihood: -4687.826
          Final log-likelihood: -2985.181
         Likelihood ratio test: 3977.686
                   Rho-square: 0.400
          Adjusted rho-square: 0.392
          Final gradient norm: +6.933e-005
                   Diagnostic: No further significant progress possible
                     Run time: 10h 13:25
      Variance-covariance: from finite difference hessian
                  Sample file: merged_data_09_10_processed.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
----	-----	-------	------	-----		------------	-----------	----------	
ASC_car	-0.166	0.307	-0.54	0.59	*	0.327	-0.51	0.61	*
ASC_cycle	1.56	0.269	5.80	0.00		0.305	5.12	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.0885	0.00710	-12.46	0.00		0.00813	-10.89	0.00	
B_cost_inc_high	0.0365	0.0153	2.38	0.02		0.0154	2.38	0.02	
B_cost_inc_low	0.0473	0.0111	4.25	0.00		0.0119	3.98	0.00	
B_cost_inc_medium_high	0.0411	0.0100	4.09	0.00		0.0107	3.85	0.00	
B_cost_inc_medium_low	0.0345	0.0104	3.34	0.00		0.0110	3.13	0.00	
B_cost_inc_verylow	0.00	--fixed--							
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	2.37	0.0977	24.27	0.00		0.119	19.99	0.00	
B_time_age_old	0.00743	0.00494	1.50	0.13	*	0.00498	1.49	0.14	*
B_time_age_young	0.00	--fixed--							
B_time_car	-0.0801	0.0121	-6.62	0.00		0.0132	-6.09	0.00	
B_time_cyc	-0.188	0.0155	-12.12	0.00		0.0182	-10.33	0.00	
B_time_fromwork	-0.0271	0.0147	-1.85	0.06	*	0.0124	-2.18	0.03	
B_time_importantreason_environment	0.0823	0.0174	4.72	0.00		0.0190	4.33	0.00	
B_time_importantreason_exercise	0.0832	0.0141	5.89	0.00		0.0158	5.26	0.00	
B_time_importantreason_flexibility	0.0221	0.0148	1.49	0.14	*	0.0167	1.32	0.19	*
B_time_importantreason_other	0.00	--fixed--							
B_time_pt	-0.0603	0.0150	-4.02	0.00		0.0158	-3.82	0.00	
B_time_speed_fast	0.00	--fixed--							
B_time_speed_slow	-0.00372	0.00497	-0.75	0.45	*	0.00504	-0.74	0.46	*
B_time_stop_per_km_few	0.00	--fixed--							
B_time_stop_per_km_many	-0.00103	0.00647	-0.16	0.87	*	0.00633	-0.16	0.87	*
B_time_towork	0.00823	0.00484	1.70	0.09	*	0.00488	1.69	0.09	*
B_time_unacceptable_distance	-0.0316	0.00383	-8.26	0.00		0.00527	-6.00	0.00	
B_time_uncomfortable_distance	-0.00836	0.00411	-2.03	0.04		0.00530	-1.58	0.11	*
B_time_weather_bad	0.0111	0.00648	1.72	0.09	*	0.00648	1.72	0.09	*
B_time_weather_good	0.00	--fixed--							
B_time_week	0.00	--fixed--							
B_time_weekend	0.00265	0.00606	0.44	0.66	*	0.00634	0.42	0.68	*
SIGMA	0.868	1.80e+308	0.00	1.00	*	56.8	0.02	0.99	*
error1	0.00	--fixed--							
error1_s	0.915	1.80e+308	0.00	1.00	*	67.6	0.01	0.99	*
error2	0.00	--fixed--							
error2_s	1.36	1.80e+308	0.00	1.00	*	21.9	0.06	0.95	*
error3	0.00	--fixed--							
error3_s	0.538	1.80e+308	0.00	1.00	*	43.6	0.01	0.99	*
missing_age	0.00	1.80e+308	0.00	1.00	*	1.38e+005	0.00	1.00	*
missing_cost	0.0184	0.0148	1.24	0.22	*	0.0138	1.33	0.18	*
missing_importantreason	0.0372	0.0129	2.88	0.00		0.0144	2.58	0.01	
missing_speed	0.00	3.06e+006	0.00	1.00	*	5.66e+005	0.00	1.00	*
missing_stop_per_km	0.00	1.80e+308	0.00	1.00	*	5.12e+005	0.00	1.00	*
missing_weather	0.00128	0.0129	0.10	0.92	*	0.0136	0.09	0.92	*
missing_weekweekend	-0.0260	0.0224	-1.16	0.25	*	0.0246	-1.06	0.29	*

Figure 0:11: MMNL1m

```
                      Model:  Mixed Multinomial Logit for panel data
         Number of Halton draws: 500
  Number of estimated parameters: 14
         Number of observations: 9120
          Number of individuals: 1140
            Null log-likelihood: -6320.809
            Init log-likelihood: -5574.910
           Final log-likelihood: -3757.064
          Likelihood ratio test: 5127.489
                    Rho-square: 0.406
            Adjusted rho-square: 0.403
           Final gradient norm: +3.078e-006
                    Diagnostic: Convergence reached
                      Run time: 02h 17:19
            Variance-covariance: from finite difference hessian
                   Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                 Value     Std err    t-test  p-val     Rob. std err  Rob. t-test  Rob. p-val
----                 -----     -------    ------  -----     ------------  -----------  ----------
ASC_car              0.906     0.358      2.53    0.01      0.365         2.48         0.01
ASC_cycle            3.34      0.331      10.10   0.00      0.353         9.46         0.00
ASC_pt               0.00      --fixed--
B_cost               -0.0683   0.00511    -13.35  0.00      0.00591       -11.55       0.00
B_cycVEG_ingen_CYC   0.00      --fixed--
B_cycVEG_meste_CYC   1.94      0.0908     21.34   0.00      0.116         16.64        0.00
B_time_car           -0.118    0.0123     -9.61   0.00      0.0133        -8.88        0.00
B_time_cyc           -0.189    0.00619    -30.47  0.00      0.00775       -24.32       0.00
B_time_pt            -0.108    0.0177     -6.09   0.00      0.0173        -6.23        0.00
SIGMA                1.81      1.80e+308  0.00    1.00    * 0.234         7.73         0.00
error1               0.00      --fixed--
error1_s             1.28      1.80e+308  0.00    1.00    * 0.188         6.82         0.00
error2               0.00      --fixed--
error2_s             0.685     1.80e+308  0.00    1.00    * 0.153         4.47         0.00
error3               0.00      --fixed--
error3_s             0.938     1.80e+308  0.00    1.00    * 0.178         5.28         0.00
sigma_time_car       0.0511    0.0329     1.55    0.12    * 0.0504        1.01         0.31         *
sigma_time_cyc       0.0623    0.00415    15.04   0.00      0.00496       12.57        0.00
sigma_time_pt        -0.00313  0.0384     -0.08   0.93    * 0.0246        -0.13        0.90         *
```

Figure 0:12: MMNL2m

```
                      Model:  Mixed Multinomial Logit for panel data
         Number of Halton draws: 700
  Number of estimated parameters: 29
         Number of observations: 9120
          Number of individuals: 1140
            Null log-likelihood: -6320.809
            Init log-likelihood: -5575.827
           Final log-likelihood: -3587.291
          Likelihood ratio test: 5467.037
                    Rho-square: 0.432
            Adjusted rho-square: 0.428
           Final gradient norm: +9.239e-006
                    Diagnostic: Convergence reached
                      Run time: 09h 27:35
            Variance-covariance: from finite difference hessian
                   Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                                 Value     Std err    t-test  p-val     Rob. std err  Rob. t-test  Rob. p-val
----                                 -----     -------    ------  -----     ------------  -----------  ----------
ASC_car                              -0.168    0.375      -0.45   0.65    * 0.388         -0.43        0.67         *
ASC_cycle                            1.53      0.341      4.48    0.00      0.362         4.22         0.00
ASC_pt                               0.00      --fixed--
B_cost                               -0.116    0.00931    -12.50  0.00      0.0106        -11.03       0.00
B_cost_inc_high                      0.0644    0.0132     4.88    0.00      0.0145        4.45         0.00
B_cost_inc_low                       0.0529    0.0153     3.47    0.00      0.0178        2.97         0.00
B_cost_inc_medium_high               0.0718    0.0110     6.53    0.00      0.0125        5.77         0.00
B_cost_inc_medium_low                0.0504    0.0125     4.03    0.00      0.0141        3.58         0.00
B_cost_inc_verylow                   0.00      --fixed--
B_cycVEG_ingen_CYC                   0.00      --fixed--
B_cycVEG_meste_CYC                   1.94      0.0904     21.41   0.00      0.114         16.99        0.00
B_time_age_old                       0.0172    0.00502    3.43    0.00      0.00521       3.30         0.00
B_time_age_young                     0.00      --fixed--
B_time_car                           -0.122    0.0117     -10.46  0.00      0.0130        -9.40        0.00
B_time_cyc                           -0.177    0.0168     -10.54  0.00      0.0221        -8.01        0.00
B_time_importantreason_environment   0.0592    0.0190     3.11    0.00      0.0222        2.66         0.01
B_time_importantreason_exercise      0.0873    0.0159     5.51    0.00      0.0211        4.15         0.00
B_time_importantreason_flexibility   0.0172    0.0168     1.02    0.31    * 0.0224        0.77         0.44         *
B_time_importantreason_other         0.00      --fixed--
B_time_pt                            -0.0931   0.0182     -5.12   0.00      0.0177        -5.26        0.00
B_time_stop_per_km_few               0.00      --fixed--
B_time_stop_per_km_many              -0.0159   0.00782    -2.03   0.04      0.00760       -2.09        0.04
B_time_unacceptable_distance         -0.0332   0.00406    -8.17   0.00      0.00592       -5.60        0.00
B_time_uncomfortable_distance        -0.0258   0.00430    -6.00   0.00      0.00504       -5.12        0.00
SIGMA                                1.15      1.80e+308  0.00    1.00    * 0.495         2.33         0.02
error1                               0.00      --fixed--
error1_s                             0.735     1.80e+308  0.00    1.00    * 0.266         2.76         0.01
error2                               0.00      --fixed--
error2_s                             1.84      1.80e+308  0.00    1.00    * 1.80e+308     0.00         1.00         *
error3                               0.00      --fixed--
error3_s                             0.235     1.80e+308  0.00    1.00    * 0.260         0.90         0.37         *
missing_age                          0.00      1.80e+308  0.00    1.00    * 1.80e+308     0.00         1.00         *
missing_cost                         0.0890    0.0279     3.18    0.00      0.0347        2.56         0.01
missing_importantreason              0.0258    0.0148     1.74    0.08    * 0.0200        1.29         0.20         *
missing_stop_per_km                  0.00      1.80e+308  0.00    1.00    * 6.50e+003     0.00         1.00         *
sigma_time_car                       0.0344    0.0170     2.02    0.04      0.0130        2.64         0.01
sigma_time_cyc                       -0.0575   0.00348    -16.54  0.00      0.00364       -15.81       0.00
sigma_time_pt                        -0.0151   0.0264     -0.57   0.57    * 0.0117        -1.29        0.20         *
```

Figure 0:13: MMNL3m

```
                     Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 700
Number of estimated parameters: 37
        Number of observations: 9119
         Number of individuals: 1140
           Null log-likelihood: -6320.809
           Init log-likelihood: -5575.827
          Final log-likelihood: -3580.969
         Likelihood ratio test: 5479.681
                    Rho-square: 0.433
           Adjusted rho-square: 0.428
           Final gradient norm: +3.768e-005
                    Diagnostic: No further significant progress possible
                      Run time: 12h 39:50
           Variance-covariance: from finite difference hessian
                   Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                                Value      Std err    t-test p-val    Rob. std err Rob. t-test Rob. p-val
----                                -----      -------    ------ -----    ------------ ----------- ----------
ASC_car                             -0.220     0.375      -0.59  0.56   * 0.385        -0.57       0.57       *
ASC_cycle                           1.51       0.342      4.42   0.00     0.362        4.18        0.00
ASC_pt                              0.00       --fixed--
B_cost                              -0.116     0.00926    -12.57 0.00     0.0105       -11.14      0.00
B_cost_inc_high                     0.0664     0.0130     5.11   0.00     0.0141       4.69        0.00
B_cost_inc_low                      0.0527     0.0149     3.53   0.00     0.0168       3.14        0.00
B_cost_inc_medium_high              0.0714     0.0109     6.55   0.00     0.0124       5.76        0.00
B_cost_inc_medium_low               0.0494     0.0125     3.96   0.00     0.0141       3.49        0.00
B_cost_inc_verylow                  0.00       --fixed--
B_cycVEG_ingen_CYC                  0.00       --fixed--
B_cycVEG_meste_CYC                  1.94       0.0906     21.42  0.00     0.114        16.99       0.00
B_time_age_old                      0.0165     0.00509    3.23   0.00     0.00526      3.13        0.00
B_time_age_young                    0.00       --fixed--
B_time_car                          -0.122     0.0117     -10.40 0.00     0.0133       -9.19       0.00
B_time_cyc                          -0.181     0.0169     -10.67 0.00     0.0216       -8.37       0.00
B_time_fromwork                     -0.00256   0.0186     -0.14  0.89   * 0.0187       -0.14       0.89       *
B_time_importantreason_environment  0.0550     0.0195     2.81   0.00     0.0223       2.47        0.01
B_time_importantreason_exercise     0.0856     0.0156     5.48   0.00     0.0198       4.32        0.00
B_time_importantreason_flexibility  0.0167     0.0162     1.03   0.30   * 0.0207       0.81        0.42       *
B_time_importantreason_other        0.00       --fixed--
B_time_pt                           -0.0925    0.0181     -5.10  0.00     0.0176       -5.26       0.00
B_time_speed_fast                   0.00       --fixed--
B_time_speed_slow                   0.00428    0.00621    0.69   0.49   * 0.00587      0.73        0.47       *
B_time_stop_per_km_few              0.00       --fixed--
B_time_stop_per_km_many             -0.0154    0.00755    -2.03  0.04     0.00693      -2.22       0.03
B_time_towork                       0.00928    0.00554    1.68   0.09   * 0.00582      1.59        0.11       *
B_time_unacceptable_distance        -0.0339    0.00408    -8.30  0.00     0.00599      -5.65       0.00
B_time_uncomfortable_distance       -0.0254    0.00428    -5.94  0.00     0.00503      -5.05       0.00
B_time_weather_bad                  0.0140     0.00717    1.95   0.05   * 0.00674      2.08        0.04
B_time_weather_good                 0.00       --fixed--
B_time_week                         0.00       --fixed--
B_time_weekend                      -0.00889   0.00654    -1.36  0.17   * 0.00611      -1.45       0.15       *
SIGMA                               1.11       1.80e+308  0.00   1.00   * 0.481        2.32        0.02
error1                              0.00       --fixed--
error1_s                            0.492      1.80e+308  0.00   1.00   * 1.80e+308    0.00        1.00       *
error2                              0.00       --fixed--
error2_s                            1.96       1.80e+308  0.00   1.00   * 7.37         0.27        0.79       *
error3                              0.00       --fixed--
error3_s                            0.114      1.80e+308  0.00   1.00   * 0.546        0.21        0.83       *
missing_age                         0.00       1.79e+006  0.00   1.00   * 1.80e+308    0.00        1.00       *
missing_cost                        0.0880     0.0272     3.24   0.00     0.0324       2.72        0.01
missing_importantreason             0.0251     0.0145     1.73   0.08   * 0.0187       1.34        0.18       *
missing_speed                       0.00       1.80e+308  0.00   1.00   * 1.80e+308    0.00        1.00       *
missing_stop_per_km                 0.00       1.50e+006  0.00   1.00   * 1.80e+308    0.00        1.00       *
missing_weather                     -7.44e-005 0.0169     -0.00  1.00   * 0.0186       -0.00       1.00       *
missing_weekweekend                 -0.0248    0.0267     -0.93  0.35   * 0.0216       -1.15       0.25       *
```

Figure 0:14: MMNL1r

```
                   Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 700
Number of estimated parameters: 14
        Number of observations: 10424
         Number of individuals: 1303
           Null log-likelihood: -7224.673
           Init log-likelihood: -6527.019
          Final log-likelihood: -4510.295
         Likelihood ratio test: 5428.756
                    Rho-square: 0.376
           Adjusted rho-square: 0.374
           Final gradient norm: +5.654e-005
                    Diagnostic: No further significant progress possible
                      Run time: 05h 16:03
           Variance-covariance: from finite difference hessian
                   Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                Value   Std err   t-test p-val   Rob. std err Rob. t-test Rob. p-val
----                -----   -------   ------ -----   ------------ ----------- ----------
ASC_car             0.471   0.322     1.47   0.14  * 0.333        1.41        0.16        *
ASC_cycle           2.77    0.308     8.98   0.00    0.331        8.36        0.00
ASC_pt              0.00    --fixed--
B_cost              -0.0548 0.00428   -12.82 0.00    0.00483      -11.35      0.00
B_cycVEG_ingen_CYC  0.00    --fixed--
B_cycVEG_meste_CYC  2.23    0.0829    26.87  0.00    0.106        20.96       0.00
B_time_car          -0.0883 0.00991   -8.91  0.00    0.0108       -8.17       0.00
B_time_cyc          -0.170  0.00514   -33.01 0.00    0.00648      -26.17      0.00
B_time_pt           -0.0744 0.0165    -4.50  0.00    0.0161       -4.61       0.00
SIGMA               -0.188  1.80e+308 -0.00  1.00  * 1.80e+308    -0.00       1.00        *
error1              0.00    --fixed--
error1_s            3.27    1.80e+308 0.00   1.00  * 2.92         1.12        0.26        *
error2              0.00    --fixed--
error2_s            10.8    1.80e+308 0.00   1.00  * 1.16         9.31        0.00
error3              0.00    --fixed--
error3_s            0.363   1.80e+308 0.00   1.00  * 0.504        0.72        0.47        *
sigma_time_car      0.0483  0.0160    3.02   0.00    0.0140       3.45        0.00
sigma_time_cyc      -0.0581 0.00340   -17.10 0.00    0.00340      -17.08      0.00
sigma_time_pt       0.00323 0.0201    0.16   0.87  * 0.00389      0.83        0.41        *
```

Figure 0:15: MMNL2r

```
                   Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 700
Number of estimated parameters: 29
        Number of observations: 10423
         Number of individuals: 1303
           Null log-likelihood: -7224.673
           Init log-likelihood: -6527.019
          Final log-likelihood: -4342.890
         Likelihood ratio test: 5763.566
                    Rho-square: 0.399
           Adjusted rho-square: 0.395
           Final gradient norm: +1.023e-004
                    Diagnostic: No further significant progress possible
                      Run time: 11h 18:46
           Variance-covariance: from finite difference hessian
                   Sample file: merged_data_09_10_processed.dat

Utility parameters
******************
Name                                  Value   Std err   t-test p-val   Rob. std err Rob. t-test Rob. p-val
----                                  -----   -------   ------ -----   ------------ ----------- ----------
ASC_car                               -0.170  0.319     -0.53  0.59  * 0.321        -0.53       0.60        *
ASC_cycle                             1.40    0.298     4.69   0.00    0.306        4.56        0.00
ASC_pt                                0.00    --fixed--
B_cost                                -0.0872 0.00748   -11.65 0.00    0.00784      -11.12      0.00
B_cost_inc_high                       0.0544  0.0112    4.84   0.00    0.0110       4.94        0.00
B_cost_inc_low                        0.0472  0.0108    4.36   0.00    0.0110       4.30        0.00
B_cost_inc_medium_high                0.0488  0.00895   5.45   0.00    0.00917      5.32        0.00
B_cost_inc_medium_low                 0.0334  0.00985   3.39   0.00    0.0104       3.21        0.00
B_cost_inc_verylow                    0.00    --fixed--
B_cycVEG_ingen_CYC                    0.00    --fixed--
B_cycVEG_meste_CYC                    2.19    0.0820    26.70  0.00    0.106        20.55       0.00
B_time_age_old                        0.0104  0.00417   2.49   0.01    0.00428      2.42        0.02
B_time_age_young                      0.00    --fixed--
B_time_car                            -0.0914 0.00952   -9.60  0.00    0.0105       -8.67       0.00
B_time_cyc                            -0.170  0.0137    -12.39 0.00    0.0176       -9.64       0.00
B_time_importantreason_environment    0.0770  0.0157    4.90   0.00    0.0183       4.20        0.00
B_time_importantreason_exercise       0.0923  0.0130    7.11   0.00    0.0165       5.61        0.00
B_time_importantreason_flexibility    0.00299 0.0142    0.21   0.83  * 0.0184       0.16        0.87        *
B_time_importantreason_other          0.00    --fixed--
B_time_pt                             -0.0565 0.0164    -3.45  0.00    0.0161       -3.51       0.00
B_time_stop_per_km_few                0.00    --fixed--
B_time_stop_per_km_many               -0.0226 0.00750   -3.01  0.00    0.00721      -3.14       0.00
B_time_unacceptable_distance          -0.0297 0.00340   -8.74  0.00    0.00483      -6.15       0.00
B_time_uncomfortable_distance         -0.0193 0.00357   -5.42  0.00    0.00424      -4.57       0.00
SIGMA                                 0.903   1.80e+308 0.00   1.00  * 0.00845      106.84      0.00
error1                                0.00    --fixed--
error1_s                              0.831   1.80e+308 0.00   1.00  * 0.603        1.38        0.17        *
error2                                0.00    --fixed--
error2_s                              1.82    1.80e+308 0.00   1.00  * 0.312        5.83        0.00
error3                                0.00    --fixed--
error3_s                              -0.350  1.80e+308 -0.00  1.00  * 0.269        -1.30       0.19        *
missing_age                           0.00    4.33e+006 0.00   1.00  * 1.80e+308    0.00        1.00        *
missing_cost                          0.0424  0.0155    2.74   0.01    0.0152       2.79        0.01
missing_importantreason               0.0367  0.0119    3.09   0.00    0.0153       2.40        0.02
missing_stop_per_km                   0.00    5.20e+006 0.00   1.00  * 1.80e+308    0.00        1.00        *
sigma_time_car                        0.0215  0.0212    1.01   0.31  * 0.0252       0.85        0.39        *
sigma_time_cyc                        -0.0527 0.00315   -16.71 0.00    0.00392      -13.46      0.00
sigma_time_pt                         0.00159 0.0263    0.06   0.95  * 0.00909      0.18        0.86        *
```

Figure 0:16: MMNL3r

```
                           Model:  Mixed Multinomial Logit for panel data
          Number of Halton draws: 700
 Number of estimated parameters: 37
          Number of observations: 10423
           Number of individuals: 1303
             Null log-likelihood: -7224.673
             Init log-likelihood: -6527.019
            Final log-likelihood: -4334.718
           Likelihood ratio test: 5779.911
                      Rho-square: 0.400
             Adjusted rho-square: 0.395
             Final gradient norm: +9.734e-006
                      Diagnostic: Convergence reached
                        Run time: 14h 55:46
             Variance-covariance: from finite difference hessian
                     Sample file: merged_data_09_10_processed.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
ASC_car	-0.151	0.320	-0.47	0.64	*	0.317	-0.48	0.63	*
ASC_cycle	1.41	0.301	4.69	0.00		0.308	4.58	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.0868	0.00753	-11.52	0.00		0.00789	-11.00	0.00	
B_cost_inc_high	0.0549	0.0112	4.92	0.00		0.0109	5.02	0.00	
B_cost_inc_low	0.0477	0.0108	4.42	0.00		0.0111	4.31	0.00	
B_cost_inc_medium_high	0.0482	0.00898	5.37	0.00		0.00925	5.21	0.00	
B_cost_inc_medium_low	0.0322	0.00982	3.28	0.00		0.0104	3.09	0.00	
B_cost_inc_verylow	0.00	--fixed--							
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	2.19	0.0818	26.80	0.00		0.106	20.64	0.00	
B_time_age_old	0.0104	0.00408	2.54	0.01		0.00407	2.55	0.01	
B_time_age_young	0.00	--fixed--							
B_time_car	-0.0915	0.00945	-9.68	0.00		0.0105	-8.68	0.00	
B_time_cyc	-0.169	0.0144	-11.68	0.00		0.0194	-8.70	0.00	
B_time_fromwork	-0.0142	0.0149	-0.95	0.34	*	0.0143	-0.99	0.32	*
B_time_importantreason_environment	0.0747	0.0166	4.51	0.00		0.0208	3.60	0.00	
B_time_importantreason_exercise	0.0889	0.0135	6.58	0.00		0.0181	4.91	0.00	
B_time_importantreason_flexibility	-0.000294	0.0149	-0.02	0.98	*	0.0200	-0.01	0.99	*
B_time_importantreason_other	0.00	--fixed--							
B_time_pt	-0.0552	0.0164	-3.37	0.00		0.0162	-3.41	0.00	
B_time_speed_fast	0.00	--fixed--							
B_time_speed_slow	-0.00170	0.00526	-0.32	0.75	*	0.00553	-0.31	0.76	*
B_time_stop_per_km_few	0.00	--fixed--							
B_time_stop_per_km_many	-0.0215	0.00766	-2.81	0.00		0.00750	-2.87	0.00	
B_time_towork	0.00498	0.00453	1.10	0.27	*	0.00440	1.13	0.26	*
B_time_unacceptable_distance	-0.0309	0.00338	-9.14	0.00		0.00480	-6.43	0.00	
B_time_uncomfortable_distance	-0.0194	0.00358	-5.41	0.00		0.00433	-4.48	0.00	
B_time_weather_bad	0.0112	0.00625	1.80	0.07	*	0.00609	1.84	0.07	*
B_time_weather_good	0.00	--fixed--							
B_time_week	0.00	--fixed--							
B_time_weekend	-0.0121	0.00553	-2.20	0.03		0.00561	-2.17	0.03	
SIGMA	0.836	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error1	0.00	--fixed--							
error1_s	0.385	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error2	0.00	--fixed--							
error2_s	2.11	1.80e+308	0.00	1.00	*	5.31	0.40	0.69	*

Figure 0:17: MMNL1u

```
                       Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 700
Number of estimated parameters: 14
        Number of observations: 6576
         Number of individuals: 822
           Null log-likelihood: -4557.443
           Init log-likelihood: -4178.378
          Final log-likelihood: -2622.226
         Likelihood ratio test: 3870.433
                    Rho-square: 0.425
           Adjusted rho-square: 0.422
           Final gradient norm: +6.856e-005
                    Diagnostic: No further significant progress possible
                      Run time: 01h 58:26
           Variance-covariance: from finite difference hessian
                   Sample file: BYEN.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
ASC_car	0.767	0.362	2.12	0.03		0.372	2.06	0.04	
ASC_cycle	3.35	0.297	11.28	0.00		0.319	10.49	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.0961	0.00637	-15.09	0.00		0.00701	-13.71	0.00	
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	2.07	0.109	18.98	0.00		0.131	15.76	0.00	
B_time_car	-0.131	0.0171	-7.67	0.00		0.0183	-7.18	0.00	
B_time_cyc	-0.209	0.00761	-27.44	0.00		0.00873	-23.93	0.00	
B_time_pt	-0.0966	0.0162	-5.98	0.00		0.0172	-5.60	0.00	
SIGMA	2.01	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error1	0.00	--fixed--							
error1_s	0.536	1.80e+308	0.00	1.00	*	0.111	4.83	0.00	
error2	0.00	--fixed--							
error2_s	1.07	1.80e+308	0.00	1.00	*	0.0270	39.54	0.00	
error3	0.00	--fixed--							
error3_s	0.192	1.80e+308	0.00	1.00	*	0.0718	2.68	0.01	
sigma_time_car	0.0348	0.0271	1.28	0.20	*	0.0205	1.70	0.09	*
sigma_time_cyc	-0.0567	0.00413	-13.71	0.00		0.00388	-14.61	0.00	
sigma_time_pt	-0.0601	0.0185	-3.25	0.00		0.0159	-3.77	0.00	

Figure 0:18: MMNL2u

```
                       Model:  Mixed Multinomial Logit for panel data
        Number of Halton draws: 700
Number of estimated parameters: 29
        Number of observations: 6576
         Number of individuals: 822
           Null log-likelihood: -4557.443
           Init log-likelihood: -4178.378
          Final log-likelihood: -2520.095
         Likelihood ratio test: 4074.695
                    Rho-square: 0.447
           Adjusted rho-square: 0.441
           Final gradient norm: +1.243e-005
                    Diagnostic: No further significant progress possible
                      Run time: 07h 35:29
           Variance-covariance: from finite difference hessian
                   Sample file: BYEN.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
ASC_car	-0.0468	0.365	-0.13	0.90	*	0.383	-0.12	0.90	*
ASC_cycle	1.80	0.297	6.07	0.00		0.322	5.60	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.121	0.00840	-14.37	0.00		0.0103	-11.78	0.00	
B_cost_inc_high	0.0310	0.0155	2.00	0.05		0.0170	1.82	0.07	*
B_cost_inc_low	0.0294	0.0172	1.71	0.09	*	0.0171	1.72	0.09	*
B_cost_inc_medium_high	0.0536	0.0119	4.50	0.00		0.0135	3.97	0.00	
B_cost_inc_medium_low	0.0536	0.0139	3.86	0.00		0.0155	3.45	0.00	
B_cost_inc_verylow	0.00	--fixed--							
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	2.03	0.107	18.98	0.00		0.127	15.95	0.00	
B_time_age_old	0.0222	0.00629	3.54	0.00		0.00667	3.33	0.00	
B_time_age_young	0.00	--fixed--							
B_time_car	-0.135	0.0164	-8.23	0.00		0.0179	-7.53	0.00	
B_time_cyc	-0.197	0.0176	-11.20	0.00		0.0206	-9.55	0.00	
B_time_importantreason_environment	0.0490	0.0213	2.30	0.02		0.0216	2.27	0.02	
B_time_importantreason_exercise	0.0830	0.0159	5.22	0.00		0.0180	4.61	0.00	
B_time_importantreason_flexibility	0.0420	0.0160	2.63	0.01		0.0180	2.33	0.02	
B_time_importantreason_other	0.00	--fixed--							
B_time_pt	-0.0892	0.0160	-5.59	0.00		0.0176	-5.07	0.00	
B_time_stop_per_km_few	0.00	--fixed--							
B_time_stop_per_km_many	-0.00228	0.00655	-0.35	0.73	*	0.00665	-0.34	0.73	*
B_time_unacceptable_distance	-0.0374	0.00456	-8.20	0.00		0.00611	-6.11	0.00	
B_time_uncomfortable_distance	-0.0152	0.00490	-3.10	0.00		0.00665	-2.29	0.02	
SIGMA	1.13	1.80e+308	0.00	1.00	*	20.9	0.05	0.96	*
error1	0.00	--fixed--							
error1_s	0.844	1.80e+308	0.00	1.00	*	10.6	0.08	0.94	*
error2	0.00	--fixed--							
error2_s	1.58	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error3	0.00	--fixed--							
error3_s	-0.0422	1.80e+308	-0.00	1.00	*	0.615	-0.07	0.95	*
missing_age	0.00	5.62e+006	0.00	1.00	*	1.75e+005	0.00	1.00	*
missing_cost	0.0467	0.0234	2.00	0.05		0.0220	2.12	0.03	
missing_importantreason	0.0223	0.0147	1.52	0.13	*	0.0167	1.34	0.18	*
missing_stop_per_km	0.00	5.48e+006	0.00	1.00	*	1.06e+005	0.00	1.00	*
sigma_time_car	0.0357	0.0276	1.29	0.20	*	0.0232	1.54	0.12	*
sigma_time_cyc	-0.0447	0.00431	-10.37	0.00		0.00438	-10.21	0.00	

Figure 0:19: MMNL3u

```
                   Model:  Mixed Multinomial Logit for panel data
       Number of Halton draws: 700
Number of estimated parameters: 37
       Number of observations: 6575
        Number of individuals: 822
          Null log-likelihood: -4557.443
          Init log-likelihood: -4178.378
         Final log-likelihood: -2511.006
        Likelihood ratio test: 4092.873
                   Rho-square: 0.449
          Adjusted rho-square: 0.441
          Final gradient norm: +1.821e-005
                   Diagnostic: No further significant progress possible
                     Run time: 09h 11:44
          Variance-covariance: from finite difference hessian
                  Sample file: BYEN.dat
```

Utility parameters
****

Name	Value	Std err	t-test	p-val		Rob. std err	Rob. t-test	Rob. p-val	
ASC_car	-0.0799	0.365	-0.22	0.83	*	0.383	-0.21	0.83	*
ASC_cycle	1.80	0.298	6.04	0.00		0.325	5.55	0.00	
ASC_pt	0.00	--fixed--							
B_cost	-0.121	0.00838	-14.39	0.00		0.0102	-11.85	0.00	
B_cost_inc_high	0.0332	0.0154	2.16	0.03		0.0167	1.99	0.05	
B_cost_inc_low	0.0271	0.0171	1.59	0.11	*	0.0168	1.61	0.11	*
B_cost_inc_medium_high	0.0541	0.0118	4.58	0.00		0.0133	4.06	0.00	
B_cost_inc_medium_low	0.0552	0.0138	3.99	0.00		0.0153	3.60	0.00	
B_cost_inc_verylow	0.00	--fixed--							
B_cycVEG_ingen_CYC	0.00	--fixed--							
B_cycVEG_meste_CYC	2.03	0.106	19.09	0.00		0.127	16.02	0.00	
B_time_age_old	0.0226	0.00600	3.77	0.00		0.00616	3.67	0.00	
B_time_age_young	0.00	--fixed--							
B_time_car	-0.132	0.0161	-8.24	0.00		0.0175	-7.59	0.00	
B_time_cyc	-0.205	0.0184	-11.15	0.00		0.0220	-9.33	0.00	
B_time_fromwork	-0.00519	0.0152	-0.34	0.73	*	0.0120	-0.43	0.67	*
B_time_importantreason_environment	0.0523	0.0209	2.50	0.01		0.0217	2.42	0.02	
B_time_importantreason_exercise	0.0826	0.0162	5.11	0.00		0.0188	4.40	0.00	
B_time_importantreason_flexibility	0.0440	0.0165	2.67	0.01		0.0193	2.28	0.02	
B_time_importantreason_other	0.00	--fixed--							
B_time_pt	-0.0891	0.0160	-5.56	0.00		0.0179	-4.97	0.00	
B_time_speed_fast	0.00	--fixed--							
B_time_speed_slow	-0.00344	0.00624	-0.55	0.58	*	0.00628	-0.55	0.58	*
B_time_stop_per_km_few	0.00	--fixed--							
B_time_stop_per_km_many	0.00185	0.00684	0.27	0.79	*	0.00716	0.26	0.80	*
B_time_towork	0.0150	0.00549	2.73	0.01		0.00553	2.71	0.01	
B_time_unacceptable_distance	-0.0382	0.00451	-8.47	0.00		0.00605	-6.31	0.00	
B_time_uncomfortable_distance	-0.0149	0.00486	-3.07	0.00		0.00651	-2.29	0.02	
B_time_weather_bad	0.0154	0.00664	2.32	0.02		0.00630	2.45	0.01	
B_time_weather_good	0.00	--fixed--							
B_time_week	0.00	--fixed--							
B_time_weekend	-0.00147	0.00732	-0.20	0.84	*	0.00726	-0.20	0.84	*
SIGMA	1.07	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error1	0.00	--fixed--							
error1_s	0.897	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*
error2	0.00	--fixed--							
error2_s	1.69	1.80e+308	0.00	1.00	*	1.80e+308	0.00	1.00	*