Master Thesis

Methodological issues in the contingent valuation of Ecosystem Services in Norway

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Abstract

Today, large parts of pasture lands in Norway have been abandoned, this has raised a discussion on how this abandoned land should be used. Statistics Norway with collaboration conducted a contingent valuation study in 2018 and 2019 to investigate peoples' willingness to pay for two measures dealing with the newly abandoned pasture lands in Norway. The measures consists of planting climate forest on the abandoned pastures, letting the abandoned pastures grow into natural forests and restoring the abandoned pastures.

This thesis investigates two methodological issues in contingent valuation of the ecosystems services in the survey. The first issue is related the relationship between the respondents' stated individual willingness to pay and the respondents' stated willingness to pay on behalf of the household in valuation of ecosystem services and whether some household and respondent characteristics can be used to explain the observed relationship. The second issue is related to whether the respondents' spatial characteristics, environmental attitudes and altruistic motivations affects the stated willingness to pay for ecosystem services. The two topics are in many ways different, but they are both connected to the validity of the study and being able to correctly estimate the welfare change. Obtaining the correct welfare measures is important from a society's perspective as it is used to weight the costs and benefits of a suggested policy change. I use Welch's t-test, Student's t-test and Wilcoxon tests to investigate the relationship between household and individual willingness to pay and a multinomial logit model to investigate whether household and respondent characteristics can be used to explain the observed relationship between household and individual willingness to pay. Further, I use a tobit model to investigate whether spatial characteristics, environmental attitudes and altruistic motivations have an effect on the stated willingness to pay for the ecosystem services in the survey. Findings show that the relationship between household and individual willingness to pay depend on the measure presented to the respondents. However, the findings give some support to the unitary household model which assumes that an individual is able to state the household's willingness to pay. Further, the results show that household and respondent characteristics can be used to explain the observed relationship. Especially characteristics explaining the structure of the household have been shown to have an effect. Lastly, the results from the tobit model show clearly that spatial characteristics, environmental attitudes and altruistic motivations have an effect on the stated willingness to pay for the ecosystems in the survey.

Preface

This master thesis marks the end of my time as a student at the Department of Economics at the University of Oslo. The past two years at the department have brought great friends and great memories.

This thesis was written with two projects funded by the Norwegian Research Council: CLIMATE-LAND: Consequences of climate policies for multiple ecosystem services of semi-natural grassland of the cultural landscape (Pnr 235560) and VALUECHANGE: Valuation of Cultural and Environmental Goods for Integrated Assessment and Decision-making: From Promise to Practice (Pnr 280393)

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Any mistakes or deficiencies in this thesis are solely my responsibility.

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Acronyms and abbreviations

CV	Contingent Valuation
CVM	Contingent Valuation Method
CE	Choice Experiment
DK	“Don’t Know”
HWTP	Household Willingness to Pay
IWTP	Individual Willingness to Pay
RP	Revealed Preferences
SP	Stated Preferences
WTA	Willingness to Accept
WTP	Willingness to Pay

1. Introduction

Forests play a central role in an environmental context. As long as forests grow they absorb carbon and store it until the wood is decomposed or burnt. This makes forests an important remedy in reducing the amount of carbon in the atmosphere. Norway has committed to cut emissions of greenhouse gases by 55 percent by 2030 compared to the 1990 level, and forest management measures to increase carbon storage could be an important mean of reaching this target. Today, two-thirds of the outfield pastures in Norway have been abandoned and are no longer in use (Grimsrud, Graesse, & Lindhjem, 2020). The Norwegian government is considering implementing a national Climate Forest Program (CFP) that consists of planting spruce climate forests on abandoned pastures. Climate forests are relatively densely planted and grow faster compared to natural forest, making it better at carbon sequestration. Also, climate forest can contribute to substitute materials that are carbon-intensive with biomass, both contributing to climate mitigation (Taeroe, Mustapha, Stupak, & Raulund-Rasmussen, 2017). The downside of spruce climate forest is its poor ability to preserve biodiversity and it may therefore raise the number of threatened species. Additionally, climate forest raises concerns about landscape aesthetics (Grimsrud et al., 2020). Pastures, however, provide cultural ecosystem services, and probably also a sense of identity and place as pastures have been an important component of a rural lifestyle and traditional farming (Iversen, Lindhjem, Jacobsen, & Grimsrud, 2019). Pastures are also better at preserving biodiversity, as many species depend on landscapes being kept open by grazing and mowing. Allowing any form of forestation will therefore increase the risk of these species going extinct (Tilman, May, Lehman, & Nowak, 1994). If the abandoned pastures are not maintained, they will eventually grow into natural forests. These types of forests reduces the number of species threatened by extinction compared to climate forests, but not compared to pasture land (Henriksen & Hilmo, 2015). Further, natural forests sequester more carbon than pasture land, but not as much as densely planted spruce climate forest.

The Contingent valuation method (CVM) is a commonly used way of obtaining people's valuation for environmental goods that are not traded in markets. Statistics Norway with collaboration conducted a contingent valuation (CV) study in 2018 and 2019 to investigate people's willingness to pay (WTP) for two measures dealing with the newly abandoned pasture lands in Norway. The measures mainly consists of planting climate forest on the abandoned pastures, letting the abandoned pastures grow into natural forests and restoring the abandoned pastures. I will in this thesis investigate two methodological issues in CV of the ecosystem

services (ES) described above. The first is investigating the relationship between the respondents' stated individual WTP and the respondents' stated WTP on behalf of the household. The aggregated welfare measure for a change in an environmental good can potentially be very different depending on whether the elicited mean individual WTP is aggregated over adult individuals or the elicited mean household WTP is aggregated over households (Lindhjem & Navrud, 2009). Response unit distortion in welfare estimates may cause considerable estimation biases, it is therefore a need for a better understanding of this relationship to obtain a valid estimation of the welfare change. Lindhjem and Navrud (2009) investigated the same relationship in their study. I will do similar investigations, but focus on some differences in the survey design in their study compared to the survey design which this thesis is based on. The second methodological issue I will investigate is how the respondents' spatial characteristics, environmental attitude and altruistic motivations influences the valuation of the ecosystem described above. In later years, spatial effects have received an increased amount of attention in the stated preferences (SP) literature as it have been shown to influence people's valuation of environmental goods (De Valck & Rolfe, 2018). Also, environmental attitudes (Johnston et al., 2017) and altruistic motivations (Liebe, Preisendörfer, & Meyerhoff, 2011) have been shown to have an effect on valuation of environmental goods. Understanding these effects are important to be able to aggregate the correct WTP in economic analysis and to control whether peoples stated preferences in CV seems reasonable. Also, it is important from a distributional point of view. The rural population and people living close to abandoned pastures may be more affected by a policy decision on ecosystem services as they often live closer to the service valued and their livelihood are often more dependent on it, but they are often outnumbered by people less affected by the service valued. It is important that policy makers are informed about these implications when making policy decisions. The two topics are in many ways different, but they are both connected to the validity of the CV and being able to correctly estimate the welfare change. Obtaining the correct welfare measures is important from a society's perspective as it is used to weight the costs and benefits of a suggested policy change.

In this thesis I will investigate (1) the relationship between household and individual willingness to pay, and whether respondent and household characteristics can be used to explain the observed relationship, and (2) whether respondents' spatial characteristics, environmental attitudes and altruistic motivations can contribute to explaining the willingness to pay for a measure dealing with abandoned pastures in Norway.

The thesis is structured as follows. Chapter 2 provides an overview over the theoretical concepts of nonmarket valuation. Also, an empirical review of the relationship between household and individual WTP, and the effect spatial characteristics, environmental attitudes and altruistic motivations have on the WTP for environmental goods. Chapter 3 provides an overview of the survey design and an explanation of the approach I will use to answer the research questions. Chapter 4 first presents the relevant descriptive statistics, then the results of the research questions. Followed by a discussion and concluding remarks in chapter 5.

2. Theory, Method and Literature

2.1 Theoretical Concepts

2.1.1 Nonmarket Valuation

When rational individuals purchase private goods and services based on their self-interest, they directly reveal their preferences for these items. This is also good for the society as a whole, at least this is the view of most neoclassical economists including Adam Smith and his "invisible hand" theory. However, there are many cases where the invisible hand does not work and the market fails to value goods properly. This is the case for most environmental goods as these are often not marketed and their economic value can therefore not be inferred from market prices (Segerson, 2017). Environmental goods are often defined as a public good because their characteristics are typically nonexcludable and nonrival. These types of good are often linked to externalities and undervaluation as they are not traded in markets. These externalities often cause environmental goods to be undersupplied from a society's perspective. To correct these externalities it is necessary to value environmental goods in an alternative way, so called nonmarket valuation methods (Segerson, 2017).

There are several ways to define ecosystem services (ES), the UN Millennium Ecosystem Assessment (MA) ES as "the benefits people obtain from ecosystems" (MEA, 2005). Economic valuation treats ecosystems as a product that continuously produce a flow of beneficial environmental goods and services which can be increased or improved in quality through restoration activities (Hanley & Barbier, 2009). As ES consists of a flow of environmental goods and services, they are not adequately accounted for in the economy. Nonmarket valuation methods are therefore also in this case the alternative way for valuing ES[1].

[1] This thesis focuses on valuating ES. However, ES an environmental goods will sometimes be used interchangeably when going through the theory and literature on the topic. I therefore remind the reader that ES are a flow of environmental goods and that they therefore are related.

Nonmarket valuation methods are generally divided into revealed preferences (RP) and stated preferences (SP) methods. RP methods use observable behavior in markets to estimate preferences. Two examples are travel cost valuation, which looks into the cost of traveling to the nonmarket good valued and Hedonic pricing, which use market prices on houses and cabins nearby to estimate preferences. While SP methods estimate the economic value of an environmental good by surveying individuals about how they would behave in constructed hypothetical scenarios. SP method is the only valuation method for non-use goods that are available to researchers[2]. The SP method is mainly applied in two forms, choice experiment (CE) and contingent valuation (CV). In CV studies respondents are typically asked to state their maximum WTP for a change in a public good, or their WTA to forgo it (Cameron & Huppert, 1989). While in CE studies respondents are asked to indicate their preferences by choosing a favored option among a discrete set of alternatives (Johnston et al., 2017). As this paper is based on a CV study, the following sections will therefore focus on relevant topics of the CVM.

2.1.2 Contingent Valuation Methods

The objective of a CV study is to obtain the monetary measure of welfare associated with a change in provision for a public good (Hoyos & Mariel, 2010). When conducting a CV study, it is important to construct a hypothetical scenario that is believable and comprehensible to the respondent so that the respondents, even when unfamiliar with the dimensions of the good or service valued, are able to give a valid response (Bateman et al., 2002). Failing to do so will cause unreliable values which can lead to wrong estimations (Mitchell & Carson, 1989), which again can have big implications as these types of estimations often used to weight the cost and benefit of a proposed policy change. The values estimated are contingent on various aspects of the scenario presented and the question asked. Aspects that may have significant influence on the respondent's valuation include the information provided about the good, the wording and type of valuation question, the institutional arrangements and the payment mechanism (Bateman et al., 2002).

To get an understanding of the economic concept of WTP, I provide in the following section the underlying economic theory of welfare measure. Consider a consumer with an indirect utility function

[2] Non-use goods are goods that are only valued for their mere existence.

$$v = v_i(p_i, y_i, s(q_i), h_i, I_i)$$

where p_i represents the vector of market prices faced by consumer i, y_i is the income of the consumer, s(q) the vector of services obtained from the environmental good available to the consumer q_i, h_i represents the non-income characteristics of consumer i, and I_i is a measure of information available to consumer i.

The act of valuation is introduced by considering a change in a fixed quantity of the environmental good q, from q^0 to q^1, keeping all other variables constant. The services obtained from the environmental good q is regarded as a "good", then $v(p, y, s(q^0), h_i, I_i) < v(p, y, s(q^1), h_i, I_i)$. The value of change in monetary terms for a consumer is represented by the compensating variation WTP which satisfies

$$v_i(p_i, y - WTP, s(q^1), h_i, I_i) = v_i(p_i, y, s(q^0), h_i, I_i)$$

and the equivalent variation WTA which satisfies

$$v_i(p_i, y, s(q^1), h_i, I_i) = v_i(p_i, y\ + WTA, s(q^0), h_i, I_i).$$

WTP and WTA > 0 as the change is regarded as an improvement. Solving for WTP then results in the general bid function

$$WTP = f(p_i, s(q^1) - s(q^0), h_i, I_i).$$

The outlined utility model for consumer preferences provides a framework one can use to interpret CV responses (Bergstrom & Taylor, 2006; Carson & Hanemann, 2005). However, it is useful to notice that one might require some additional consideration for the interpretation depending on the questioning format in the CVM. The present CV survey uses a payment card with a set of threshold values the respondents can choose from. Since respondents does not state a value themselves, I need to make some considerations when interpreting the responses. This is further discussed under the empirical approach.

2.2 Empirical Research

2.2.1 Household and Individual WTP

In this section I will go through some of the existing literature on the topic household and individual WTP. As the research question regarding this topic is similar to what Lindhjem and Navrud (2009) investigate, the section will build on their paper.

The CVM is one of the most widely used approaches to elicit population welfare effects of an increase in environmental goods and services. A typical way of conducting a CV study is to ask among a random population sample for their maximum willingness to pay (WTP) for an increase in an environmental good or service. There are typically two alternative ways of phrasing the WTP question[3].

1. How much are you, individually, willing to pay for an increase in quantity of an environmental good?
2. What is the most you would be willing to pay, on behalf of your household, for an increase in the quantity of an environmental good?

Or some variation of these phrasings (see, e.g., Strand (2007), Lindhjem and Navrud (2009), Ebert (2013)). The first question relates to the respondent's individual change in welfare, and the second one relates to the welfare of the household. The second question interprets the household as a unit and assumes that the respondent can correctly state the household WTP. If the first phrasing was used in a CV study, the elicited mean WTP would normally be added up over adult individuals to obtain society's collected valuation of the good, while the elicited mean of the second phrasing would normally be added up over households. There are some issues with this approach, as there is no known research confirming that when individuals are asked to state their individual WTP that they only state their individual WTP. The same problem arises in CV methods asking for household WTP, there is no indication that respondents are able to state the true household WTP. Failing to address this issue can lead to substantial miscalculation of welfare estimates. The issue of which response unit to use in CVM have long been recognized in the CV literature (Mitchell & Carson, 1989), but have received little attention in later research. Becker (1981)'s unitary model claims an individual in the household will be capable of making choices on behalf of the household. An important assumption in this model is income pooling income. The household then maximizes their utility subject to a single budget constraint, and this can be done by any (adult) individual part of the household. Munro

[3] These questions are formulated as open-ended questions, but one can do the same distinguishing in dichotomous questions. The questions would then be phrased: "are you/your household willing to pay an x amount…"

(2005) argues that in households where income pooling is satisfied, individual and household WTP will be equal independently of other household mechanisms, lending some support to the unitary model.

In recent years the unitary model has been increasingly criticized. Empirical studies argue that the income pooling assumption of the unitary model is not supported. Multiple studies prove that the way household income is spent depend on who earns it (Bateman & Munro, 2009; Himmelweit, Santos, Sevilla, & Sofer, 2013) and that the income is spent differently depending on whether it is controlled by the husband or the wife (Duflo, 2003; Lundberg, Pollak, & Wales, 1997; Prabhu, 2010). Groossbard (2011) points out that the unitary model assumes benevolent altruism in individuals making decisions on behalf of the household, and that this causes them to exhibit the same preferences on behalf of themselves and on behalf of the household. However, Strand (2007) and Quiggin (1998) argue that if respondents and family members exhibit interpersonal preferences such as altruism, the stated household WTP should be higher than stated individual WTP. Even when a household member try to accurately predict the beliefs and preferences of family members towards a product, they often fail (Lerouge & Warlop, 2006). In an experiment containing 220 husbands and wives trying to predict their partner's preferences, about half of them would have predicted their partner's preferences more accurately if they simply reported their own preferences. Also, only 53 percent of the participants were able to predict their partner's preferences better than a hypothetical forecaster that simply used the average gender-specific preferences of the partner (Davis, Hoch, & Ragsdale, 1986). Also, Frederick (2011) finds that people in general tend to overestimate others' WTP for goods and services. Flurry and Burns (2005) argues that parents tend to underestimate their children's influence over family decision making, affecting both their individual and household's WTP as children might influence their preferences without them being aware. The second question above relates to the household welfare, which cannot be defined without bearing in mind the welfare of the member of the household (Chiappori, 2016). However, accurately predicting other household members' preferences seems to be an almost impossible task for respondents.

Lindhjem and Navrud (2009) finds that when asking the same respondents for their individual and household WTP for preserving biodiversity in old-growth forests in Norway, that household WTP is larger than individual WTP. When comparing household WTP and individual WTP between two samples, where one sample were asked to state their individual

WTP and the other sample were asked to state their household WTP, there were no significant difference between the two.

Some studies have investigated whether certain characteristics can contribute to explaining the relationship between individual and household WTP. Delaney and O'Toole (2004) finds that when a person is asked to state their WTP without specifying whether they should answer on behalf on the household or themselves (in this case in the context of public service broadcasting in Ireland), a person who is females, married and has children is more likely to respond as a household instead of as an individual. Delaney and O'Toole (2008) finds in the context of WTP for increased levels of social transfers in Ireland that respondents from households were finances are conducted jointly are about 18 percent more likely to respond with household WTP instead of individual WTP when the response unit is not specified. Lindhjem and Navrud (2009) found that older people and an increasing number of household members have a significant higher probability of stating equal individual and household WTP compared to stating a household WTP higher than their individual WTP. This might be because a longer relationship and having children involved will make the household more tightly integrated and therefore the difference between the individual and the household get blurred. Men, however, are more likely to state a household WTP higher than individual WTP.

2.2.2 Spatial Characteristics, the NEP Scale and Altruism

Spatial dimensions have in later years received an increasing amount of attention in SP welfare evaluation (Glenk, Johnston, Meyerhoff, & Sagebiel, 2020). Sutherland and Walsh (1985) were some of the firsts to emphasize the importance of spatial aspects in SP valuation. Later, multiple studies have proven that spatial factors have an impact on the valuation of various environmental goods (see eg. Budziński, Campbell, Czajkowski, Demšar, and Hanley (2018), Hassan, Olsen, and Thorsen (2019), Radford and James (2013), Rolfe and Windle (2012), Zhou, Koomen, and van Leeuwen (2018)). Failure to account for spatial factors can strongly impact value estimates and compromise the validity and reliability of the study (De Valck & Rolfe, 2018).

Location gives rise to two classes of spatial effects; spatial dependence and spatial heterogeneity (Anselin, 1992). Spatial dependence follows directly from Tobler (1979) stating that "Everything is related to everything else, but near things are more related than distant things". Consequently, people living nearby each other are more likely to have similar values and opinions, leading to spatial cluster. This means that households in closer proximity to each other tends to have similar WTP for environmental goods compared to respondents living

further away from each other. One possible reason for why these preference clusters arises is that individuals choose their residence location according to their preferences (Toledo-Gallegos, Long, Campbell, Börger, & Hanley, 2021). The second spatial effect, spatial heterogeneity, takes form as a consequence of regional differences following from the inherent uniqueness of each location (Anselin, 1992). People often develop an emotional connection with what is local and familiar to them, and this might influence their valuation (Toledo-Gallegos et al., 2021). This is shown in Budziński et al. (2018) where they find that people living in areas with more species-rich forest and those living nearer bigger areas of mixed forests have a significant different WTP for environmental conservation compared to people living in other areas. Also, Faccioli, Czajkowski, Glenk, and Martin-Ortega (2020) finds that people with a greater attachment to peatlands also displays a higher WTP for peatland restoration. While Rolfe and Windle (2012) finds that the WTP to pay to protect the health of the Great Barrier Reef can be explained by future usage, rather than proximity to the good. This indicates that some of the distance decay effect can be explained by usage of the good rather than proximity of the good, even though the two likely are to some extent related.

Another spatial factor that have been shown to influence people's attitude towards environmental goods is the difference between urban and rural dwellers. Bergmann, Colombo, and Hanley (2008) and Silva, Rodrigues, Vieira, Batistella, and Farinaci (2017) finds that urban residents in developed countries tends to prefer nature conservation to a greater degree than rural citizens. Bergmann et al. (2008) analyses preferences for renewable energy developments and summarizes urban preferences as: "Urban residents prefer project that have a low or no landscape impacts, do not harm wildlife and do not generate air pollution". While rural residents are usually more dependent on the use of natural resources for their livelihood. This is confirmed in Bergmann et al. (2008), He finds that rural residents preferences for renewable energy projects are heavily influenced by whether the projects creates new permanent jobs. Opposite results have also been found. Olive (2014) finds that urban Canadians have little awareness of endangered species and conservation policy, and that they feel less responsible for conservation compared to farmers. Clearly, there are differences in preferences between rural and urban citizens. It is important to be aware of these differences as the rural population are likely more directly affected by a policy action than the urban population, while the urban population often outnumber the rural residents and are therefore major stakeholders from the point of view of policy makers and resource managers. Understanding the differences between

these two populations will therefore inform decision-makers on implications of the policy decisions (Hassan et al., 2019).

Dunlap and Van Liere (1978)'s New Environmental Paradigm (NEP) was published after environmental issues started to receive an increasing amount of attention in the 1970's and policy makers were in need of a way to measure peoples' environmental attitude to make informed policy choices. The NEP scale was therefore created to measure proenvironmental orientation. At the time, the major issues that achieved a prominent position on policy agendas around the world tended to be air and water pollution, loss of aesthetic values, and resource (especially energy) conservation. The NEP scale therefore focused primarily on these conditions when measuring the environmental concerns of the public. The NEP scale consist of 12 Likert items and is composed of three distinct dimensions - balance of nature, limits to growth and human domination of nature. For many years the NEP scale was widely used. However, in recent decades the environmental concerns have changed and evolved. Although the issues above are still relevant, environmental issues have generally tended to become of a more global character and are less directly observable. Also, their causes are more complex and synergistic. There has also been a growing awareness of how modern industrialized societies alter the physical environment, and the way this affects the surrounding ecosystems. The evolvement of environmental issues caused the need for a revised NEP scale (Dunlap, Van Liere, Mertig, & Jones, 2000). Dunlap et al. (2000) therefore created an improved version of the NEP scale, renamed the New Ecological Paradigm scale, consisting of 15 Likert items. This revised version taps into a wider range of facets of an ecological worldview, offers a balanced set of pro- and anti NEP items, and avoids outmoded terminology.

SP studies has for long contributed to environmental economic valuation, but it has been criticized for failing to account for the complexity that drive economic values (Costanza et al., 2017). McFadden (2001) argues that people's preferences are not only influenced by easily observed characteristics, but also unobservable factors such as attitudes, motivations and beliefs. Accounting for these unobserved factors will allow for a better understanding of how environmental goods are valued (Ben-Akiva et al., 2002). Johnston et al. (2017) recommends considering environmental attitudes in SP studies to better characterize respondents' behavior. The NEP scale are one of the most used ways to implement environmental attitudes into studies. The results from these studies generally show that WTP for ecosystem services and environmental goods tend to increase with more positive environmental attitudes (see e.g.

Faccioli et al. (2020), Ntanos, Kyriakopoulos, Skordoulis, Chalikias, and Arabatzis (2019), Halkos and Matsiori (2017) and Aldrich, Grimsrud, Thacher, and Kotchen (2007)).

Altruistic motivations are also shown to have an effect on valuation of environmental goods. Liebe et al. (2011) argues that altruistic motivation can contribute to preservation of environmental goods because of people's perceived obligations. People with altruistic motivations might feel obliged to contribute to preserve ES such that future generations and others will benefit from it. Also, altruistic motivations might contribute to preservation of ES as individuals with this characteristic obtain personal satisfaction when financially contributing to a public good, yielding individual utility. CV responses does therefore not only reflects the WTP for the economic value of the good, but also for the moral satisfaction of contributing to public goods (Kahneman & Knetsch, 1992).

3. Survey Design, Research Questions and Econometric Approach

In this section I will go through the survey design, the research questions and the approach to answer the research question.

The internet CV survey was conducted in December of 2018 and January of 2019 by the data collection-agency Norstat. The purpose of the CV survey was to get insight into Norwegians opinions and preferences on planting climate forest to tackle climate change and to estimate their WTP for various measures regarding land management of newly abandoned pastures. The survey was also designed so that it is possible to investigate the relationship between household and individual WTP. The respondents answering the survey are from Norstat's panel. Half of the respondents responded to a CE study and the other half responded to a CV study. I will only focus on the CV part of the survey. Respondents within the CV study are divided into three samples. All samples are given the same set of background questions, but the valuation part of the survey is different.

3.1 Survey Design

The survey started with collecting some background information about the respondents, such as age, marital status, number of children and where the respondent live. The respondents are also asked about their general attitude towards environmental concerns as a political issue to create awareness of their own environmental preference. Respondents are then informed about the amount of pasture land abandoned in Norway, and that this land is about to grow into natural forests. 8500 square kilometers of former Norwegian pasture land is already reforested with natural forest and today there is around 1350 square kilometers of pasture land left in Norway.

The respondents are further informed that Statistics Norway conduct this survey to collect information that will be used as a basis for policy decisions on land management. Three possible approaches to tackle abandoned pasture land are presented, the first is letting the pasture grow into natural forest, the second is planting climate forest on the abandoned pasture land and the last is recovering the abandoned pastures. Respondents are presented with pictures of how these three options will look in a few decades, and also a ranking of the ecosystems' ability to preserve biodiversity. Natural forest is ranked in between pasture land resulting from traditional grazing and pastureland resulting from conventional grazing[4], while climate forest is ranked lowest in preservation of biodiversity. The three options are also ranked based on their contribution to tackle climate change. Climate forest is in this case ranked highest as this densely planted spruce forest captures three times as much CO_2 as natural forest. Pastureland both in conventional and traditional form is ranked lowest and takes up relatively little CO_2, while natural forest is ranked in between climate forest and pasture land.

All the information provided might be considered a lot to take in. Respondents were therefore given questions along the way to keep them activated and encourage response. After all the information had been given, respondents were asked to indicate on a scale from one to eight whether they are positive towards planting climate forest to tackle climate change, or negative towards planting climate forest to preserve species and a more diverse landscape. Respondents with a value of four or below are considered relatively negative to planting climate forest, while respondents with a value above four is considered relatively positive to planting climate forest. The respondents are then divided into three samples. Sample 1A and 1B consist of respondents that are negative to planting climate forest, while sample 2 consist of respondents that are positive to planting climate forest. The respondents replying "don't know" (DK) to the above question are divided equally between the three samples

Further, the three samples are asked to state their WTP for two different measures dealing with the abandoned pastures. Measure A is the same for all three samples and is a scenario where 50 percent of the abandoned pasture land is recovered, 25 percent of the abandoned pasture land is used to plant climate forest and the remaining 25 percent of the abandoned pasture land is

[4] Traditional grazing occurs when different kinds of livestock graze on unfertilized ground, while conventional grazing (the modern kind) is usually one type of livestock grazing on fertilized and often plowed grounds. Conventional grazing does not preserve biodiversity as well as traditional grazing, but both kinds of grazings keep the landscape open.

left alone and will eventually grow into natural forest. Measure B is different depending on whether the respondents are positive or negative towards planting climate forest. The respondents that are negative towards planting climate forest, sample 1A and 1B, are presented with a scenario where 75 percent of the abandoned pasture land is recovered and the remaining 25 percent of the abandoned pasture land is left alone and will eventually grow into natural forest. Respondents that are positive towards planning climate forest, sample 2, are presented with a measure B where 50 percent of the abandoned pasture land is used to plant climate forest and the remaining 50 percent are left alone and will eventually grow into natural forest[5]. The measures presented to respondents in sample 1A and 1B is shown in **Error! Reference source not found.** and the measures presented to respondents in sample 2 is shown in Figure 5, both in the appendix. The respondents are informed that the alternative to the two measures they are presented with is doing nothing and letting all the abandoned pasture land grow into natural forests. The respondents are also informed that the cost of potential measures will be covered by an increase in income tax.

3.1.1 Household and Individual WTP

Sample 1A and 1B are in a reversed order asked to state their household and individual WTP, this will be used to investigate the relationship between household and individual WTP. Sample 1A is first asked to state the household WTP for the two measures (the first WTP question) before they are prompted to think about and state their individual WTP (the second WTP question). In the first WTP question, when sample 1A is informed about the payment vehicle and how it influences the respondent's economy, the survey focused on specifying that the increased income tax will influence the household's economy so that the respondent will have the economy of the household in mind when answering the first question. They are also reminded that stating a zero value will lead to a scenario where no measure will be implemented. The first question about measure A is presented as follows: "How much is it worth to your household to implement measure A?". The first question about measure B, replaces A with B in the quotes. The respondents are presented with a payment card and state their WTP by moving a marker along a horizontal non-linear scale containing 10 amounts until the desired value is reached. The scale goes from 0 NOK to 3840 NOK, it is also possible to choose "more than 3840" and "don't know" (at the end of the scale). If the respondents choose "more than 3840" they are asked to specify their WTP in a separate box. After stating the

[5] Measure B presented to respondents in sample 2 will not be used in this thesis.

household WTP for the two measures, the respondents are instead asked to think about their individual WTP for the two measures. The question is presented as follows: "Would you change your answer if you only were thinking about yourself, not your household?". Respondents are encouraged to think about the income they have available compared to the income of the household and whether their personal opinion on the topic corresponds with the opinions of those in the household. The payment card they are presented with for the second WTP questions is a drop-down menu as shown in Figure 6 in the appendix. The options on this payment card are the same as the ones in the payment card presented they are presented with in the first WTP questions, except they are not asked to specify a sum if they choose "above 3840". The value previously stated (the household WTP) for the two measures are shown above the drop-down menu, making it easy for the respondents to think about whether their WTP has changed in this scenario

The design of the questions given to sample 1B are the same as given to 1A, except the response unit is revered, as well as the way the questions were phrased. Sample 1B is first asked to state their individual WTP for the two scenarios before they instead are asked to think about and state their household WTP. In this case, the information given about the payment vehicle focuses first on how the income tax affects the respondent as an individual, the respondent is also asked to think about themselves instead of the household. The design of the two payment cards presented to sample 1B are the same as the ones presented to sample 1A. Sample 1B are first asked to state their individual WTP on a horizontal non-linear scale before they are asked with a drop-down menu if they want to change the answer if they instead are asked to represent their entire household.

After the WTP questions, both samples were directed to a set of questions exploring the underlying reasons for why they responded to the WTP questions as they did. The respondents were given 5-6 suggested reasons depending on whether their household WTP were higher, lower or the same as their individual WTP. They were asked to rate the given reasons as either "not at all important", "slightly important", "important" or "fairly important" as to why they responded to the WTP questions as they did. Figure 7 in the appendix show the design of these questions. Respondents stating in the beginning of the survey that they are single and live alone are not asked to state both their household's and their individual WTP. Instead, the people living alone in sample 1A are asked to state their household WTP, while the people living alone in sample 1B are asked to state their individual WTP.

In the end, all respondents are directed back to a set of background questions regarding respondent and household characteristics

3.1.2 Spatial Characteristics, NEP and Altruistic Motivations

I use samples 1A and 2 to investigate whether spatial characteristics affects the stated household WTP as respondents in these two samples are both asked to state their household WTP first. In this way the results will not be affected by whether the respondents were asked about individual or household WTP first. We also account for differences in preferences towards planting climate forest as sample 1A is defined as negative towards planting climate forest, while sample 2 is defined as positive towards planting climate forest. As measure B presented to the respondents is different in sample 1A and 2, I will only use measure A to investigate the effect spatial characteristics, environmental attitudes and altruistic motivations have on the valuation of ecosystem services.

The survey collects data on where the respondents live and whether respondents have a house or a cabin close to either pasture land reforested into natural forest, climate forest or pasture land. They are also asked whether they use any of the three ES regularly for recreational purposes. Respondents are further asked a set of questions related to attitudes on altruism and environmental issues. A shortened NEP scale is used to obtain information on the environmental attitudes of the respondents. Whitmarsh (2008) found that several people had difficulties interpreting 9 of the 15 revised NEP items, these were therefore excluded from the survey. The remaining six items in the shortened version are found in Table 3. The survey also includes three questions revealing the respondents' altruistic motivations, these are found in Table 4. Both the shortened NEP scale and the attitude questions on altruism are presented with a 5 point Likert scale.

3.1 Approach to answer research questions

The economic model of welfare measurement provides the economic concept of WTP, and while it is a good to understand the valuation of an environmental good, it has some limitations. I will in this thesis investigate two of the methodological issues connected to the economic model of welfare measurement. The first is that that the economic model of welfare measurement does not differentiate between household and individual WTP. The standard approach in microeconomic models is consumers maximizing their utility facing a budget constraint, but does not specify whether the consumer have the household in mind when solving the maximization problem. This is a weakness as CV studies often ask respondents for their household's WTP. Household and individual WTP is undoubtedly connected in some way or

another, but as reviewed in the literature, it is often challenging for individuals to differ between their personal wishes and the wishes of the household. It is therefore important to obtain a better understanding of this relationship in CVM as it can cause huge biases in welfare estimates. The second methodological issue is understanding how non-income characteristics (h in the model) effects the valuation of environmental goods. I will investigate how spatial characteristics, environmental attitudes and altruistic motivations influences the valuation of measure A, as the literature suggests that these three factors affects the valuation of environmental goods. Understanding how these factors influences the valuation is important to be able to aggregate the correct WTP in economic analysis and to control whether peoples preferences stated in CV seems reasonable. Also, it is important from a distributional point of view. The literature argues that respondents more affected by a change in the good or service valued (e.g. rural respondents or respondents living close to the good valued) are often outnumbered. Being aware of these implications is therefore important when weighing the costs and benefits of a suggested policy change. The two methodological issues are different, but they both affect the validity of the CV and whether one obtain the correct welfare measure. Obtaining the correct welfare measurement is important as it is used to balance the costs and benefits of policy decisions.

I specified some research questions I will investigate in the further analysis:

I. Do respondents within the same sample change their WTP when the response unit is reversed in terms of whether they are asked for household or individual WTP, and what are their underlying reasons for doing so?
II. What is the observed relationship between the annual mean household WTP and the annual mean individual WTP, and can household and respondent characteristics be used to explain the observed relationship between household and individual WTP?
III. Can spatial characteristics, environmental attitudes and altruistic motivations be used to explain the stated amount of household WTP for measure A? And can altruistic motivations and environmental attitudes be used to explain some of the differences between urban and rural respondents?

The first research question is specified to observe the number of respondents changing their answer from the first to the second WTP question and to see whether I can find any trends in how respondents are changing their answers. And also explore the underlying stated reasons for doing so. To answer research question II) I have in Table 1, based on what is done in Lindhjem and Navrud (2009), specified a set of hypotheses that will be used to investigate the relationship between the mean household and individual WTP. I will also investigate whether

household and respondent characteristics can be used to explain the observed relationship between household and individual WTP.

Table 1. Testable hypothesis of mean household and individual WTP [a]

	Between samples	Within samples	References [b]
H1	$\overline{HWTP_{1A}^{m}} > \overline{IWTP_{1B}^{m}}$	$\overline{HWTP_{k}^{m}} > \overline{IWTP_{k}^{m}}$	Lindhjem and Navrud (2009) in the within sample comparison and Strand (2007) when the respondent exhibit interpersonal preferences
H2	$\overline{HWTP_{1A}^{m}} = \overline{IWTP_{1B}^{m}}$	$\overline{HWTP_{k}^{m}} = \overline{IWTP_{k}^{m}}$	Lindhjem and Navrud (2009) in the between sample comparison and Munro (2005) when income pooling is satisfied
H3	$\overline{HWTP_{1A}^{m}} < \overline{IWTP_{1B}^{m}}$	$\overline{HWTP_{k}^{m}} < \overline{IWTP_{k}^{m}}$	Lindhjem (2007)
H4	$\overline{HWTP_{1A}^{m}} = \overline{n} \times \overline{IWTP_{1B}^{m}}$	$\overline{HWTP_{k}} = \overline{n} \times \overline{IWTP_{k}}$	Strand (2007), response bias evens out in large samples
	One-person household comparison		
H5	$\overline{SHWTP_{1A}^{m}} = \overline{SIWTP_{1B}^{m}}$		Strand (2007): $HWTP_i = 1 \times IWTP_i$

Note: [a] $\overline{HWTP}$ = the mean household WTP, $\overline{IWTP}$ = the mean individual WTP. $\overline{SHWTP}$ and $\overline{SIWTP}$ represents the mean household and individual WTP for singles living alone. m = measure A and B, and k = sample 1A and 1B. [b] the relationships discussed at an individual level in the literature are assumed can be extended to the mean level.

Research question (I) and II) and the testable hypothesis in Table *1* are similar to what is explored in Lindhjem and Navrud (2009), but there are some noticeable differences. First, the present survey asks for the respondents' WTP for two different measures, compared to only one in Lindhjem and Navrud (2009). This makes it possible to investigate whether the relationship between household and individual WTP depend on the policy measure presented. Second, Lindhjem and Navrud (2009) excludes the respondents stating their household WTP lower than their individual WTP when investigating the sunderlying reasons for why respondents stated their household and individual WTP as they did. Also when they explore whether household and respondent characteristics can be used to explain the observed relationship between household and individual WTP. I do not remove these respondents in the analysis of this thesis. Third, the respondents stating that they live alone in sample 1A are asked to state their household's WTP, while the respondents who live alone in sample 1B are asked to state their individual WTP. Logically, these two should be equal as these single individual

represents their entire household. Also, Strand (2007)'s theory of household WTP being equal the sum of household members' individual WTP in large samples should make the household WTP equal individual WTP for one-person households. Testing hypothesis H5 in Table *1* is then a way of investigating whether asking one-person households for their household WTP compared to asking for their individual WTP affects their stated mean WTP, this is not done in Lindhjem and Navrud (2009). And lastly, the Lindhjem and Navrud (2009) study, like mine, explores whether household and respondent characteristics can be used to explain the observed relationship between individual and household WTP. Although, compared to the Lindhjem and Navrud (2009) study, the present survey collects more information on the respondents and their household. I will place a significant weight on characteristics representing the structure of the household when exploring the observed relationship between household and individual WTP, as I believe this will have an effect on household and individual WTP. This was not done in the Lindhjem and Navrud (2009).

Answering research question (III) is fairly straightforward. I will under empirical approach describe the variables I include in the analysis to answer this question.

3.3 Econometric Approach

3.3.1 Data Treatment

The payment cards used in the survey presents the respondent with the option of choosing "don't know" (DK). Groothuis and Whitehead (2002) points out the benefit of presenting the respondents with a DK option, as it ensures that uncertain and uninformed respondents are not forced to state a WTP as this would decrease the quality of elicit responses. However, the DK option can also lead to a reduction in sample size and econometric efficiency, as the DK option might discourage respondents to put in the effort necessary to report their true WTP (Krosnick et al., 2002). To limit the damage of the DK option, it is necessary with follow-up questions in the survey to get an explanation of the respondent's choice (Arrow et al., 1993). This makes it possible to specify "protest" responses and remove them from the sample. It is also common to specify "protest" responses among respondents stating a zero answer and remove them from the sample (Brouwer, 2006). Respondents in the survey that stated either a zero or DK response to at least one of the WTP questions are asked to state their most important reason for not providing a positive value. This makes it possible to separate the ones that replied zero or DK in protest from the ones that stated it as their legitimate response. The respondents are given eight suggested reasons they can choose from, and in the case the respondents did not feel like

any of the reasons fit them, they could specify a reason themselves. Respondent's stating a zero value or DK to one of the WTP questions in protest were removed from the sample[6]. It was further assumed that the remaining respondents with a DK response are opposers to the suggested policy implementation and have a WTP equal to zero.

Respondents often find it difficult to name a specific sum when asked about their WTP for a good, often leading to a problem of non-response. Payment cards contributes to avoiding this problem as it presents the respondents with a set of threshold values the respondents can choose from. The downside of using payment cards is that the stated values obtained is in the form of intervals rather than a continuous point valuation (Cameron & Huppert, 1989). According to the economic model of welfare measure one also needs to make additional consideration when interpreting the WTP, as the respondents do not specify a WTP themselves. The survey askes the respondents to state their WTP by the mean of a payment card, the respondent's true WTP then lies between the value stated and the next possible value on the payment card. I account for this in the analysis by assuming that the respondent's true WTP is on average in the middle of the value stated and the next possible value on the payment card[7].

3.3.2 Household and Individual WTP

To investigate research question (I) in the specified research questions, I investigate the number of respondents changing their answer from the first to the second WTP question (where the response unit were reversed). I also make graphs to obtain an overview of the respondents' underlying reasons for responding to the household and individual WTP as they did. The graphs show the importance distribution of the suggested reasons given after the WTP questions. The suggested reasons depend on whether they stated a higher, lower and/or the same household WTP compared to individual WTP. Figure 1, Figure 2 and Figure 3 sum up the results for household WTP higher, lower and the same as individual WTP, respectively, pooled for both samples.

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[6] Respondents choosing zero or DK for the following reasons where registered as protest responses: "the tax level is already too high", "what I say won't affect whether the measures are implemented or not", "I feel it is not right to measure the environment and climate in money", "I do not want to pay before I know what it will cost" and "It was too difficult to arrive at an amount". The respondents choosing "my household/I cannot afford to pay for this", "I feel like other societal tasks should be prioritized" or "I prefer that the land management continues as it is today" were registered as legitimate responses. Also, I went through the self-specified reasons and categorized them into protest and legitimate responses based on similarities to the phrasings above.

[7] An exception is the zero values remaining after removing the protestors and assuming the remaining DK responses are actually zero responses. The zero responses then remaining are categorized as genuine zero responses and are therefore not changed.

To analyze question (II), I calculate the annual mean WTP[8] for all the WTP questions in each sample and test them according to Table *1*. Table 2 compares mean values of household and respondents' characteristics, it indicates no reason for applying weighting procedures or using covariates in the estimation of the mean WTP. When testing the hypothesis in the between sample mean comparison in Table *1* I use Welch's t-test. Welch's t-test is a two-sample location test used to test the null hypothesis that two populations have equal means. The test accounts for unequal sample sizes and unequal sample distribution variance and is an adaption of the standard Student's t-test. Sample 1A and 1B have unequal sample sizes and Welch's t-test is insensitive to equality of the variance, making it fitting for the between sample mean comparison. For the within sample mean comparison I use a standard Student t-test to test the hypotheses in Table *1*.

Both the Welch's t-test and the Student's t-test assumes normal distribution of WTP, which is not the case for either of the samples. The distribution of WTP (even in the logarithmic form) is right-skewed. I therefore also choose to carry out a Wilcoxon rank-sum test (between sample comparisons) and a Wilcoxon signed-rank test (within sample comparison). These tests are non-parametric statistical hypothesis tests and does not rely on the assumption of normal distribution. The Wilcoxon signed-rank test tests the null hypothesis that the median of a distribution is equal, while the Wilcoxon rank-sum test tests the null hypothesis that two independent samples are from populations with the same distribution. When testing hypothesis H4 in Table *1*, I use Statistics Norway's estimate for mean household size in Norway, the number was last updated in June of 2020 and are estimated to be 2.14[9] (SSB, 2020b).

I also posted the question of whether respondent and household characteristics can be used to explain the observed relationship between household and individual WTP. To explore this question, I use a multinomial logit model[10] where the dependent variable can take three values

[8] In the first WTP question given, if respondents chose "above 3840" on the payment card they were asked to specify their WTP. This was not asked for in the second WTP question (where the response unit was reversed). I therefore choose not to use this self-specified WTP in the analysis as it would lead to an upward bias for the first WTP questions. In the case a respondent chooses "above 3840", it will be registered as the value 3841 in the analysis.

[9] Lindhjem and Navrud (2009) have information on the mean household sizes in their data, this mean household size exclude one-person households. The mean household size of 2.14, which I use in the analysis does not exclude one-person households, resulting in the mean household size for in this study being lower than the mean household size in Lindhjem and Navrud (2009).

[10] I also specified and tested models using WTP difference (HWTP-IWTP), WTP ratio (HWTP/IWTP) and a standard logit model with a binary dependent variable of 1 if HWTP>IWTP and/or HWTP<IWTP, and 0 if HWTP=IWTP. These gave a generally lower explanatory power. Also, it is not unlikely that the respondent had a clearer idea of the direction than the magnitude of the difference between household and individual WTP.

depending on whether respondents state a lower, the same, or higher household WTP compared to individual WTP. The multinomial logit method guarantees the fitted probabilities will be between 0 and 1. The estimations are based on the following model

$$Pr(y = k|\boldsymbol{x}) = \frac{\exp\left(\beta_0^k + \beta_1^k x_1 + \cdots + \beta_p^k x_p\right)}{\sum_{j=1}^{K} \exp\left(\beta_0^j + \beta_1^j x_1 + \cdots + \beta_p^j x_p\right)}$$

where y is the categorical response variable, which can take the value k=1,3 representing the categories $HWTP_i < IWTP_i$ and $HWTP_i > IWTP_i$, respectively, while k=2 is the baseline category and represents the category $HWTP_i = IWTP_i$ (Neath & Johnson, 2010).
The predictor variables $\boldsymbol{x} = (x_1, x_2, \dots, x_p)$ is used to estimate the $\boldsymbol{\beta} = (\beta_1, \beta_2, \dots, \beta_p)$ regressors by maximum likelihood techniques (Agresti, 2002). Respondents are placed in the base category ($HWTP_i = IWTP_i$) if they state the same individual and household WTP for both measures. The remaining respondents are placed in one of the two other categories (k=1,3) depending on whether they stated a lower or a higher household WTP compared to individual WTP for one or both of the measures[11]. The results from the multinomial logit regression for both separate and pooled samples are found in Table 10.

I will use many of the same predictor variables as Lindhjem and Navrud (2009), but in comparison to the Lindhjem and Navrud (2009) study, I have more information on the structure of the household. As I believe this might contribute to explain the relationship between household and individual WTP, I add them to the regression. More specifically, I believe that in a household where either the respondent or the respondents' partner make most of the decisions in the household, the respondent are more likely to have a household WTP different than their individual WTP. I include variables indicating who in the household makes the everyday household choices, who makes decisions on the household investments, who controls the household resources, who owns the household property, and who decided the location the household settled down. I also include variables indicating whether the respondent and their partner have a joint bank account and how much of the partner's income goes into joint family finances. I further include an interaction term between a variable indicating a household where the respondents' partner make most of the everyday household choices and a gender variable

[11] 4 of the respondents in sample 1A and 1 respondent is sample 1B state a lower household WTP for one of the measures and a higher household WTP compared to individual WTP for the other measure. These 5 respondents are removed from the regression as they do not fit into only one of the comparison categories.

to explore whether the stated household and individual WTP is sensitive to the gender of respondents living in households where their partner makes most of the everyday household decisions. In addition, I control for how familiar respondents are with the ES valued by including variables indicating whether the respondent regularly uses the ES valued and whether the respondent's household live close to any of them. I include a variable indicating whether or not the respondent have donated some of their points earned during their time in the Norstat panel as this can indicate altruism (DellaVigna, List, & Malmendier, 2012), which may affect the respondents stated preferences. A variable indicating whether the respondent communicated with the rest of the household during the survey is also included, as this might make the respondents more aware of the different opinions in the household towards the ES valued. The explanatory variables divided into respondent and household characteristics and are found in Table 2.

3.3.3 Spatial Characteristics, NEP and Altruistic Motivations

To investigate question (III) I need to account for the right-skewness in the distribution of the stated WTP. Sample 1A and 2 contain a nontrivial fraction of respondents with a WTP of zero, while the remaining positive WTP values are roughly continuously distributed. To account for the amount of zero values in the analysis, the literature suggest using a tobit model with left censoring (Wooldridge, 2018). The tobit model is specified as follows

$$y^* = \beta_0 + \boldsymbol{\beta x} + u, where\ u \mid \boldsymbol{x} \sim Normal(0, \sigma^2)$$
$$y = \max(0, y^*)$$

where y* is the unobserved latent variable required to satisfy the classical linear model assumption. This implies that the observed WTP (y) and the latent WTP (y*) are equal when the stated $WTP \geq 0$, and $WTP = 0$ otherwise. The predictor variables $\boldsymbol{x} = (x_1, x_2, \dots, x_p)$ is used to estimate the $\boldsymbol{\beta} = (\beta_1, \beta_2, \dots, \beta_p)$ regressors by maximum likelihood techniques as in the multinomial logit regression (Wooldridge, 2018).

The set of explanatory variables used in the regression is shown in

Table 5. As living nearby and usage of the good valued might impact the WTP I control for this by adding variables indicating whether the respondent have a house or a cabin closer than 500 meters to planted (climate) forest, pasture land or pasture land reforested into natural forest, or

regularly use them for recreational purposes. Further I add a group of variables indicating which region in Norway the respondent live in, as this might influence the valuation of the ES. The influence can both come from spatial dependence and spatial heterogeneity since respondents living in the same area more likely have similar opinions and are also used to having the same type of ecosystems around them. To check whether there is a difference between urban and rural respondents I include a centrality index made and distributed by Statistic Norway (SSB, 2020c). I also use data on population density to see whether this has an effect on the stated WTP, this data is also made and distributed by Statistic Norway (SSB, 2020a). The centrality index give a measure of the centrality to each municipality in Norway. The measure of centrality is given by assigning a value to each municipality between 0 and 1000, where a value of 1000 is the highest measure of centrality. The index is put together by dividing all municipalities into 13 500 basic statistical units, and combining the results of two sub-indices. The first contain a measure of the number of workplaces people living within one of the 13 500 basic statistical units can reach within 90 minutes, while the second measures the number of service establishments people living within each of the 13 500 units can reach within 90 minutes. 90 minutes was chosen as a cutoff point as less than 1 percent of the Norwegian population have an above 90 minute commute to work according to the travel habit survey conducted by TØI in 2014 (SSB, 2020c). The data on population density contains a measure on the number of people per square kilometer in each municipality (SSB, 2020a). Both the index and the data on population density can be connected to the survey data by the municipality code[12]. It is often easier to find trends within the extreme parts of the sample, I have therefore chosen to split the continuous centrality index into a categorical variable where one category contains the rural respondents living in municipalities within the bottom 20th percentile of the centrality measure. The second contains the urban respondents living in municipalities within the top 20th percentile of the centrality index. The respondents in the remaining middle 60th percentile are places in the last category and is used as a base outcome.

To measure the respondents' environmental attitude, each respondent is given a NEP score depending how they respond to the 6 NEP items. Table 3 shows how the NEP items are coded.

[12] The survey was conducted in late 2018 and beginning of 2019, since then, there have been multiple mergers of municipalities and regions causing new municipality codes. The centrality index was upgraded and improved in 2020 and contains only the new municipality codes making it difficult to merge the centrality index with the survey data as the survey data uses the old municipality codes. To solve this issue I used data from Kartverket.no containing municipality codes for both 2019 and 2020 (Kartverket, 2020).

A respondent strongly agreeing with all NEP questions will get the highest possible score of 30 (6x5), while a respondent strongly disagreeing with all NEP questions will get a score of 6 (6x1). A high NEP score reflects a high ecocentric orientation, while a low NEP score is associated with an anthropogenic orientation reflected by positiveness towards exploration of natural resources. The NEP score is further split into quartiles, as done in Whitmarsh (2008), and used in the tobit regression. To measure the respondents' altruistic motivations I give the respondents an altruism score depending on how they responded to the questions on altruism. I obtain the altruism score in the same way as the NEP score and the coding for the altruism questions are found in Table 4. Respondents strongly agreeing with all altruism questions get the highest possible score of 15 (3x5), while respondents strongly disagreeing with all altruism questions get the lowest possible score of 3 (3x1). The altruism score is further split into tertiles, where the top tertile is associated with a high degree of altruism. To explore whether some of the possible difference between urban and rural respondents can be explained with environmental and altruistic attitudes, I include interaction terms. One interaction term with the centrality index and the NEP score, and one with the centrality index and the altruism score. I also include variables indicating whether the respondent donate some of the points earned during their time in the Norstat panel to charity and whether the respondent is relatively positive towards planting climate forest, as this might contribute to give a better picture of the respondent's altruistic motivations and environmental attitudes. Lastly, I control for a set of sociodemographic characteristics as this most likely have an effect on the stated WTP.

4. Results and Analysis

In this section I will present some descriptive statistics of sample 1A and 1B used to investigate research question (I) and (II), and some descriptive statistics of sample 1A and 2 pooled used to investigate research question (III). I also present the results from the econometric approach.

4.1 Descriptive Statistics

4.1.1 Household and individual WTP

After the treatment procedure of the DK and zero responses, it is useful to assess variables used for the regression more closely. Sample 1A and 1B used to answer question (I) and (II) now consist of 445 observations, 242 in sample 1A and 205 in sample 1B. These numbers exclude the respondents who report living alone, as these respondents only answer the WTP questions

once and are therefore excluded from most of the analysis. There are 69 single respondents living alone in sample 1A and 47 in sample 1B. Table 2 shows an overview of the respondent and household characteristics of the 445 respondents in multi-person households[13]. Overall the mean and standard deviation are generally very similar between samples and there is no significant difference in means in any of the variables.

Table 2. Explanatory variables and sample means (st.dev) sample 1A and 1B

Variables	Definition	Sample 1A	Sample 1B
Respondent characteristics			
Age	Continuous: >19 years	55.23 (1.004)	54.50 (1.142)
Female	Dummy: 1 if female; 0 if male	0.479 (0.033)	0.459 (0.035)
Edu	Dummy: 1 if >2 years of university education; 0 otherwise	0.574 (0.032)	0.541 (0.035)
Member	Dummy: 1 if member of an environmental or nature organization; 0 otherwise	0.186 (0.025)	0.210 (0.029)
Use	Dummy: 1 if climate forest, pasture land and/or pastureland reforested with natural forest used for recreation > 12 times in last 12 months; 0 otherwise.	0.826 (0.024)	0.863 (0.024)
Donate	Dummy: 1 if respondent have donated some of the points/money earned from participating in Norstat panel surveys; 0 otherwise.	0.132 (0.022)	0.102 (0.02)
Household characteristics			
married	Dummy: 1 if married; 0 otherwise	0.603 (0.032)	0.629 (0.034)
HH_inc	Dummy: 1 if household income > 800 000 NOK; 0 otherwise	0.413 (0.032)	0.449 (0.035)
Child	Dummy: 1 if children <15 years of age in household; 0 otherwise	0.298 (0.029)	0.263 (0.031)
BankAccount	Dummy: 1 if respondent and partner have a joint bank account; 0 otherwise	0.256 (0.028)	0.293 (0.031)
Pincome_joint	Dummy: 1 if >50% of partner's income goes into joint household finances; 0 otherwise	0.550 (0.032)	0.537 (0.035)
Choices	Dummy: 1 if respondent make most of the everyday household choices ; 0 otherwise	0.236 (0.027)	0.229 (0.029)

[13] The respondents in sample 1A and 1B are relatively negative towards planting climate forest, but this should not affect whether they change their stated WTP from the first to the second WTP questions, only the overall amount stated.

Investment	Dummy: 1 if respondent does most of the household investments; 0 otherwise	0.306 (0.030)	0.307 (0.032)
Resources	Dummy: 1 if respondent have most responsibility of allocating household resources; 0 otherwise	0.384 (0.031)	0.351 (0.033)
Partner_choices	Dummy: 1 if respondent's partner make most of the everyday household choices; 0 otherwise	0.062 (0.016)	0.102 (0.021)
Property	Dummy: 1 if respondent have the most ownership of household property; 0 otherwise	0.182 (0.025)	0.132 (0.024)
Living	Dummy: 1 if respondent mostly decided where the household settled down; 0 otherwise	0.380 (0.031)	0.376 (0.034)
House	Dummy: 1 if house < 500 meter from climate forest, pasture land and/or pasture land reforested with natural forest; 0 otherwise	0.533 (0.032)	0.541 (0.035)
Com_HH	Dummy: 1 if respondent communicated to any household members while replying to the survey; 0 otherwise	0.161 (0.024)	0.015 (0.025)

4.1.2 Spatial Characteristics, NEP and Altruistic Motivations

The treatment of the DK and zero responses are also done to sample 1A and 2. After the treatment, the pooled sample consists of 749 observations, 304 respondents in sample 1A and 445 respondents in sample 2. Table 3 presents the items in the shortened NEP scale, the frequency distribution of the responses to the five point Likert scale and the mean response for each item[14]. A mean above three indicates an ecocentric orientation, while a mean below three indicates an anthropogenic orientation. The respondents have a total mean of 3.8, which indicates that the average respondent have an ecocentric orientation and favors preserving natural resources. Table 4 shows the frequency distribution of the responses to the questions on altruism answered with a five point Likert. The same concept applies here, a mean score above three indicates altruism, while a score below three indicates a more egoistic respondent. The total mean is 4.19 which indicates that the average respondents are of an altruistic kind.

Table 5 gives an overview of explanatory variables for sample 1A and 2 pooled later used in the tobit regression.

[14] Note that the NEP items and questions on attitudes towards altruism are answered with a Likert scale. The "distance" between the scale items are not necessarily the same, calculating the mean is therefore somewhat problematic. Still, the mean can indicate whether the respondents have an ecocentric or anthropogenic orientation.

Table 3. Frequency distribution and mean for the shortened NEP items

	Do you agree or disagree [a] that:	SD[b]	D	DK	A	SA	Mean[c]
1.	Humans have the right to modify the natural environment to suit their needs	2%	25%	11%	43%	19%	3.51
2.	Humans are severely abusing the environment	1%	9%	7 %	48%	37%	4.10
3.	The balance of nature is strong enough to cope with impacts of modern industrial nations	3 %	16%	11%	50%	20%	3.69
4.	Plants and animals have as much right as humans to exist	2 %	14%	6 %	48%	31%	3,92
5.	Humans were meant to rule over the rest of nature	4%	20%	11%	41%	24%	3,63
6.	The balance of nature is very delicate and easily upset	1 %	5 %	7 %	53%	34%	4.15
						Total mean	3.83

[a] Agreement with even-numbered items and disagreement with the odd-numbered items. [b] SD = strongly disagree, D = disagree, DK= don't know, A = agree, SA = strongly agree. Frequencies may not sum up to 100 due to roundings. [c] Statements are coded such that SD = 1, D = 2, DK = 3, A = 4 and SA = 5.

Table 4. Frequency distribution and mean for questions on altruism

	Do you agree or disagree [a] that:	SD[b]	D	DK	A	SA	Mean[c]
1.	It is important for me to "be there" for family, friends and the local community	0%	3%	3%	48%	46%	4.37
2.	I am generally a person a person who thinks most of myself	1%	11%	5 %	57%	24%	3.93
3.	I am willing to share with others without expecting anything in return	1 %	4%	4%	61%	32%	4.19
						Total mean	4.16

[a] Agreement with items 1 and 3, and disagreement with items 2. [b] SD = strongly disagree, D = disagree, DK= don't know, A = agree, SA = strongly agree. Frequencies may not sum up to 100 due to roundings. [c] Statements are coded such that SD = 1, D = 2, DK = 3, A = 4 and SA = 5.

Table 5. Explanatory variables and sample means (st.dev) pooled sample 1A and 2

Variables	Definition	Pooled sample
Age	Continuous: >19 years	54.879 (0.622)
Female	Dummy: 1 if female; 0 if male	0.482 (0.018)
Edu	Dummy: 1 if >2 years of university education; 0 otherwise	0.517 (0.018)
HH_inc	Dummy: 1 if household income > 800 000NOK; 0 otherwise	0.315 (0.017)
Donate	Dummy: 1 if respondent donate some of the points/money earned from participating in Norstat panel surveys to charity; 0 otherwise.	0.139 (0.013)
Group variable: region		
Nord-Norge	Dummy: 1 if respondent live in Nord-Norge; 0 otherwise	0.116 (0.012)
Midt-Norge	Dummy: 1 if respondent live in Midt-Norge; 0 otherwise	0.176 (0.014)
Vestlandet	Dummy: 1 if respondent live in Vestlandet; 0 otherwise	0.246 (0.016)
Østlandet	Dummy: 1 if respondent live in Østlandet; 0 otherwise	0.284 (0.016)
Sør-landed including Telemark	Dummy: 1 if respondent live in Sørlandet including Telemark; 0 otherwise	0.071 (0.009)
Oslo	Dummy: 1 if respondent live in Oslo, 0 otherwise	0.107 (0.011)
Pop_denisty	Continuous: number of people per square kilometer in the municipality the respondent lives	426.517 (20.279)
House_cforest	Dummy: 1 if house or cabin is <500 meter from panted (climate) forest; 0 otherwise	0.393 (0.019)
House_nforest	Dummy: 1 if house or cabin is <500 meter from abandoned pasture land reforested with natural forest, 0 otherwise	0.459 (0.182)
House_pasture	Dummy: 1 if house or cabin is <500 meter from pasture land; 0 otherwise	0.513 (0.029)
Centrality_index	Measure of centrality, values from 0 to 1000	818.980 (4.658)
NEP score	Measure of environmental attitudes, values from 6 to 30	22.968 (0.148)
Altruism score	Measure of altruism, values from 3 to 15	12.489 (0.063)
Pro_cforest	Dummy: 1 if respondent is defined as relative positive to climate forest for recreational purposes; 0 otherwise	0.505 (0.018)
Use_cforest	Dummy: 1 if respondent use planted forest more than once a month; 0 otherwise	0.696 (0.017)
Use_nforest	Dummy: 1 if respondent use abandoned pasture land reforested with natural forest more than once a month for recreational purposes; 0 otherwise	0.542 (0.018)
Use_pasture	Dummy: 1 if respondent use pasture land more than once a month for recreational purposes; 0 otherwise	0.662.017)

4.1.3 Representativeness

The respondents of the survey are recruited by Norstat, and were sampled to be representative of the Norwegian population. Both sample 1A and 1B pooled and 1A and 2 pooled are close to

representative of the Norwegian population. Except both the pooled samples have an underrepresentation of those under 50 years of age and an overrepresentations of those over 66 years of age[15]. The gender distribution and education level in the two pooled samples are similar to what is found in the Norwegian population. Looking at sample 1A and 2 pooled, the regional distribution is similar to what is found in the Norwegian population, except there is a slight overrepresentation of respondents living in the region Midt-Norge and a slight underrepresentation of respondents living in the region Østfold.

4. 2 Household and Individual WTP

4.2.1 Stated WTP and the Underlying Reasons

Table 6 shows the number of respondents changing their stated WTP from the first to the second WTP question. Looking at the combined column, most respondents do not change their stated WTP from the first to the second WTP question, 219 respondents in sample 1A and 178 respondents in sample 1B state the same household and individual WTP for at least one of the measures. The respondents that do change their answer from the first to the second WTP question have a tendency to state a household WTP higher than their individual WTP. Also, respondents in sample 1B does more often state a household WTP higher than their individual WTP compared to respondents in sample 1A. 43 respondents in sample 1B increase their bid from the first to the second WTP question resulting in a household WTP higher that their individual WTP for at least one of the measure. While only 23 respondents in sample 1A reduces their bid from the first to the second WTP resulting in a household WTP higher than their individual WTP. The reason for this is not immediately clear, but this is further discussed in the discussion section below. Few respondents stated a household WTP lower than their individual WTP, only 22 respondents in sample A and 11 respondents in sample B did so.

Table 6. Number of respondents stating HWTP>IWTP, HWTP=IWTP or HWTP<IWTP

	Sample 1A			Sample 1B		
	Measure A	Measure B	Combined[a]	Measure A	Measure B	Combined
HWTP > IWTP	20	16	23	30	36	43
HWTP = IWTP	215	205	219	166	164	178
HWTP < IWTP	7	21	22	9	5	11
N	242	242	264	205	205	232
Sample size	242	242	242	205	205	205

[a] The combined column shows the amount of times respondents state a lower, higher and/or the same WTP for either questions on measure A, B, or both. The number of observation in the combined column is higher than the sample size, this is because respondents might for example state a higher household WTP compared

[15] Only respondents between 19 and 80 years old answered the survey. I therefore only compare the samples with the Norwegian population within the same age gap.

to individual WTP for measure A and the same household and individual WTP for measure B causing them to be registered twice.

I will now investigate the respondents' stated reason to why they stated household and individual WTP as they did by creating an overview of how respondents rated the importance of the follow-up question received after the WTP questions. Figure 1, Figure 2 and Figure 3 sums up the results for respondents stating a household WTP higher, lower and the same, respectively, as their individual WTP for the pooled sample.

Figure 1 shows the distribution of replies by respondents stating a household WTP higher than individual WTP. Respondents rated their most important reasons for why they stated a household WTP higher than individual WTP that both incomes were taken into consideration when answering the household WTP questions and that the partner's WTP is added to their own WTP. Only 14 percent and 23 percent, respectively, rated these reasons as not at all important. These results suggests that individuals do not seem to consider the partner's income as part of their own budget constraint when answering the individual WTP question. Considering children especially is also an important reason for why household WTP is larger than individual WTP. 67 percent rated this reason as somewhat important to why household WTP is larger than individual WTP. The reasons "household budget is bigger than individual budget" and "partner's preference" does not seem to be as important. 44 percent and 55 percent, respectively, rated these reasons as not important.

Figure 2 shows the distribution of replies from respondents stating a household WTP lower than their individual WTP. The results show that the most important reason for why household WTP is lower than individual WTP is that respondents are able to pay more when they are not thinking about the household. Only 18 percent rated this reason as not important. The second and third most important reasons for individual WTP being lower that household WTP is that the respondent's individual budget is bigger than household budget and that the topic is less important to their partner. 57 percent and 56 percent, respectively, rated these reasons as somewhat important. These results can give some support to the fact that it seems like individuals do not take into account the partner's income and WTP for goods when stating their individual WTP. When individuals are given the opportunity of only thinking about themselves, they can make choices only based on their own preferences and do not think about how the household would benefit. The reason "partner is against the measures" is rated the least important reason to why individual WTP is higher than individual WTP. 78 percent rated this reason as not important.

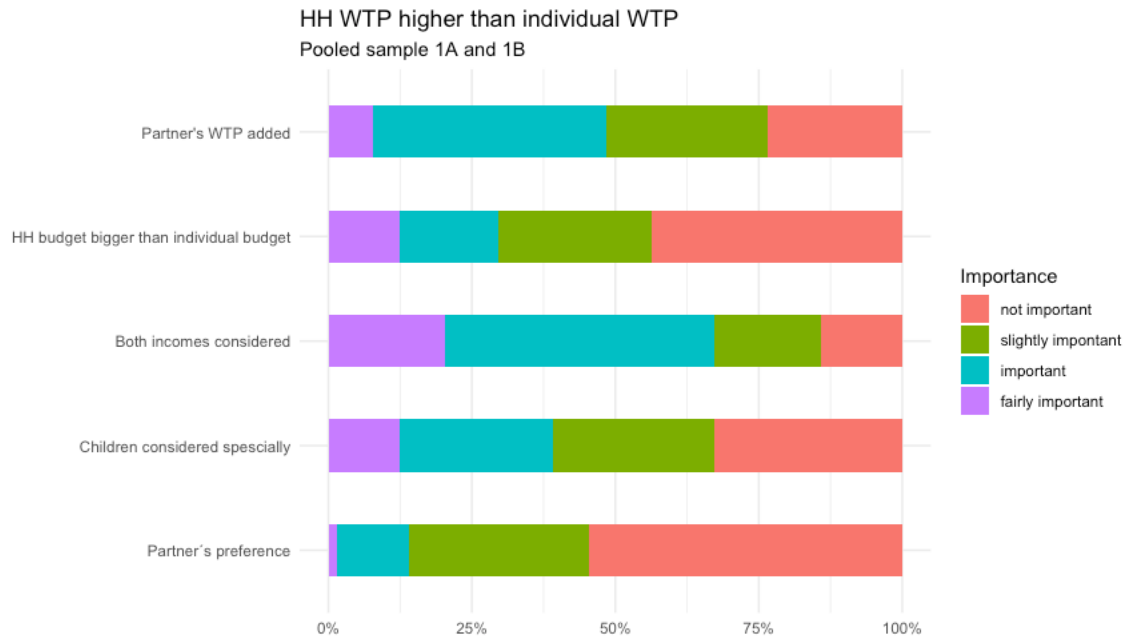

Figure 1. Percentage of respondents rating given reasons for HWTP>IWTP (N=64)

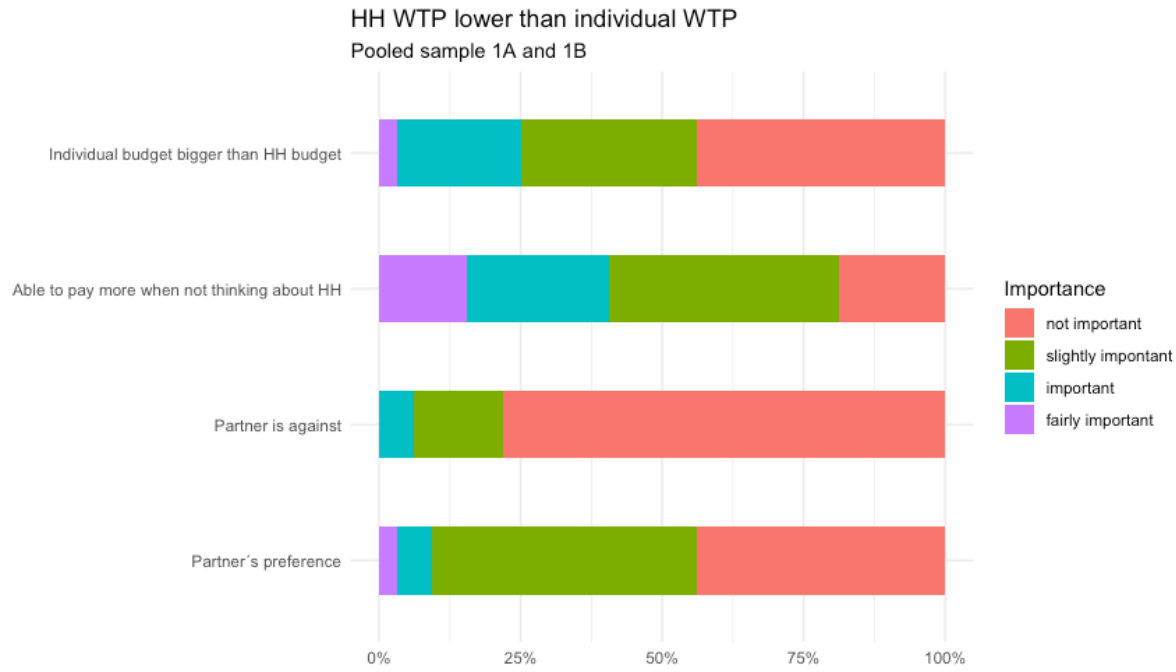

Figure 2. Percentage of respondents rating given reasons for HWTP<IWTP. (N=32)

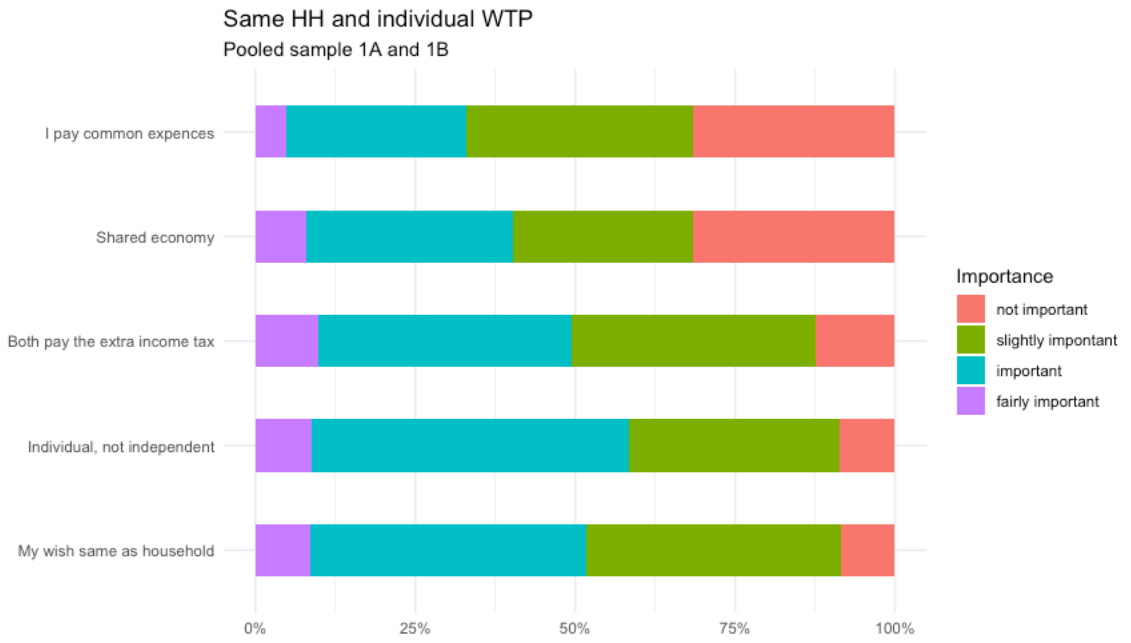

Figure 3. Percentage of respondents rating given reasons for HWTP=IWTP (N=389)

Figure 3 shows the distribution of answers among respondents stating the same WTP for the household and themselves. The two most important reasons for why the respondents state equal household and individual WTP are that the respondents' wish corresponds with the wish of the household, and that even though they are asked to state their individual WTP does not mean that they are independent people, not thinking about anyone else. 8 percent and 9 percent, respectively, rated these reasons as not important. These results are an indication of a unitary household model where the respondents maximizes the households utility under a single budget constraint. The fact that both have to pay the extra income tax should one of the measures be implemented is also an important reason for why the respondents stated the same household and individual WTP. 13 percent rated this reason as not at all important. The reasons "I pay common expenses" and "shared economy" is considered less important. In both cases 31 percent rated these reasons as not at all important.

4.2.2 Comparison of Annual Mean WTP

Table 7 show the annual mean household and individual WTP for each sample. Looking at the first WTP question for measure A, the mean household WTP for sample 1A is higher than the mean individual WTP for sample 1B. 878 NOK compared to 719 NOK. Running a Welch's t-test reports a t-value of 1.68, which gives a significant result for H1, $\overline{HWTP_{1A}^{A}} > \overline{IWTP_{1B}^{A}}$, in the between sample comparison in Table 1. The rejection of hypothesis H2 and H3 then

logically follows. Looking at the first WTP question for measure B, the household WTP (1047 NOK) for sample 1A is higher than the mean individual WTP (960 NOK) for sample 1B. Running the same Welch's t-test reports a t-value of 0.82 and the null hypothesis H2, $\overline{HWTP_{1A}^{B}} = \overline{IWTP_{1B}^{B}}$, in the between sample comparing cannot be rejected. Rejection of hypothesis H1 and H3 then logically follows. I also use a Welch's t-test to test hypothesis H4, I obtain a t-value of -4. 17 for measure A and -5.68 for measure B leading to rejection of hypothesis H4 in the between sample comparison for both measures. Table 8 shows a summary of the empirical results from testing the hypothesis for the between[16] and within sample comparison, and the one-person households comparison.

Table 7. Mean annual individual and household WTP (st.error) in NOK

WTP	Sample 1A			
questions	Measure A	95% CI	Measure B	95% CI
1st	$\overline{HWTP_{1A}^{A}} = 878\ (66)$	(747, 1010)	$\overline{HWTP_{1A}^{B}} = 1047\ (75)$	(901, 1195)
2nd	$\overline{IWTP_{1A}^{A}} = 835\ (64)$	(708, 962)	$\overline{IWTP_{1A}^{B}} = 1083\ (77)$	(933, 1234)
N	242		242	
WTP	Sample 1B			
questions	Measure A	95% CI	Measure B	95% CI
1st	$\overline{IWTP_{1B}^{A}} = 719\ (68)$	(586, 852)	$\overline{IWTP_{1B}^{B}} = 960\ (76)$	(812, 1110)
2nd	$\overline{HWTP_{1B}^{A}} = 747\ (69)$	(611, 883)	$\overline{HWTP_{1B}^{B}} = 1009\ (78)$	(853, 1164)
N	205		205	

Table 6 show that most respondents have either the same or higher household WTP compared to individual WTP. This means that for the second WTP question, where response units are reversed, respondents in sample 1A (asked for household WTP first) should generally have reported a lower WTP. While sample 1B (asked for individual WTP firt) should generally have increased their WTP in the second WTP question. Looking at Table 7 this is mostly correct, except for when sample 1A is questioned about measure B. In this case, the respondents have an annual mean individual WTP equal to 1083 which is slightly higher than the mean household WTP equal to 1047.

[16] The between sample comparison only shows the mean comparison of the first WTP questions for both measures, not the second WTP question.

Table 8. Summary of empirical results by hypothesis

	Between samples[a]			
	Measure A	Test results	Measure B	Test results
H1	$\overline{HWTP_{1A}^{A}} > \overline{IWTP_{1B}^{A}}$	Supported	$\overline{HWTP_{1A}^{B}} > \overline{IWTP_{1B}^{B}}$	Rejected
H2	$\overline{HWTP_{1A}^{A}} = \overline{IWTP_{1B}^{A}}$	Rejected	$\overline{HWTP_{1A}^{B}} = \overline{IWTP_{1B}^{B}}$	Supported
H3	$\overline{HWTP_{1A}^{A}} < \overline{IWTP_{1B}^{A}}$	Rejected	$\overline{HWTP_{1A}^{B}} < \overline{IWTP_{1B}^{B}}$	Rejected
H4	$\overline{HWTP_{1A}^{A}} = \overline{n} \times \overline{IWTP_{1B}^{A}}$	Rejected	$\overline{HWTP_{1A}^{B}} = \overline{n} \times \overline{IWTP_{1B}^{B}}$	Rejected
	Within samples[b]			
	Measure A	Test results	Measure B	Test results
H1	$\overline{HWTP_{k}^{A}} > \overline{IWTP_{k}^{A}}$	Supported 1A, rejected 1B	$\overline{HWTP_{k}^{B}} > \overline{IWTP_{k}^{B}}$	Supported 1B, Rejected 1A
H2	$\overline{HWTP_{k}^{A}} = \overline{IWTP_{k}^{A}}$	Supported 1B, Rejected 1A	$\overline{HWTP_{k}^{B}} = \overline{IWTP_{k}^{B}}$	Supported 1A, rejected 1B
H3	$\overline{HWTP_{k}^{A}} < \overline{IWTP_{k}^{A}}$	Rejected 1A & 1B	$\overline{HWTP_{k}^{B}} < \overline{IWTP_{k}^{B}}$	Rejected 1A&1B
H4	$\overline{HWTP_{k}^{A}} = \overline{n} \times \overline{IWTP_{k}^{A}}$	Rejected 1A & 1B	$\overline{HWTP_{k}^{B}} = \overline{n} \times \overline{IWTP_{k}^{B}}$	Rejected 1A & 1B
	One-person household[b]			
	Measure A	Test results	Measure B	Test results
H5	$\overline{SHWTP_{k}^{A}} = \overline{SIWTP_{k}^{A}}$	Supported	$\overline{SHWTP_{k}^{B}} = \overline{SIWTP_{k}^{B}}$	Supported

[a] Between sample comparison of the first WTP question. [b] k= sample 1A and sample 1B

I use a standard student´s t-test to test for differences in annual mean WTP within the samples. When testing for difference in the mean household and individual WTP for sample 1A measure A, I obtain a t-value of 2.47. Hypothesis H1 in Table *1*, $\overline{HWTP_{1A}^{A}} > \overline{IWTP_{1A}^{A}}$, is then supported at a 5 percent level. While for sample 1B measure A, the null hypothesis H2, $\overline{HWTP_{1B}^{A}} = \overline{IWTP_{1B}^{A}}$, cannot be rejected at a 5 percent level. In the within sample comparison of measure B I observe the opposite. Hypothesis H1, $\overline{HWTP_{1B}^{B}} > \overline{IWTP_{1B}^{B}}$, is supported at a 5 percent level for sample 1B, while for sample 1A the null hypothesis H2, $\overline{HWTP_{1A}^{B}} = \overline{IWTP_{1A}^{B}}$, cannot be rejected at a 5 percent level. Hypothesis H4 in Table *1* is also rejected in the within sample comparison of both measures.

One-person households only responded to the WTP question for each measure once, single respondents living alone in sample 1A were only asked for their household WTP, while single

respondents living alone in sample 1B were only asked to state their individual WTP. Table 9 shows the annual mean WTP for one-person households. Since these people live alone there should be no difference between the responses for individual WTP and household WTP. Running a Welch t-test confirms this, there is no significant difference in mean WTP between household WTP in sample 1A and individual WTP in sample 1B for either of the two measures and hypothesis H5 in Table 1 is supported.

Table 9. Mean annual WTP (st.error) for one-person households

	Sample 1A		Sample 1B	
	Mean	95 % CI	Mean	95% CI
Measure A	$\overline{SHWTP_{1A}^{A}} = 780\ (121)$	(539, 1021)	$\overline{SHWTP_{1B}^{A}} = 931\ (159)$	(611, 1252)
Measure B	$\overline{SHWTP_{1A}^{B}} = 1115(139)$	(839, 1392)	$\overline{SHWTP_{1B}^{B}} = 1342\ (204)$	(931, 1754)

The above testes assumes that the stated WTP is normally distributed, when they in fact are right-skewed. I therefore also run a Wilcoxon test, which have no assumptions on distribution. Running a Wilcoxon rank-sum test on the first WTP question for measure A between the samples show that we can reject the null hypothesis at a 10 percent level. The same test on the first WTP question on measure B between the samples shows that the null hypothesis that two independent samples are from population with the same distribution cannot be rejected at a 5 percent level. These results can give some support to the between sample comparison done with a Welch's t-test, where $\overline{HWTP_{1A}^{A}} > \overline{IWTP_{1B}^{A}}$ where supported for measure A and $\overline{HWTP_{1A}^{B}} = \overline{IWTP_{1B}^{B}}$ could not be rejected for measure B. For the within sample comparison I use a Wilcoxon signed-rank test. For sample 1A measure A, the test shows a significant difference in distribution of household and individual WTP at a 5 percent level. For sample 1A measure B, the test show no reason to reject the null hypothesis of equal distribution. Supporting the results obtained in the within sample mean comparison for sample 1A above. For sample 1B, I cannot reject the null hypothesis for neither measure A or B, giving some support to the results obtained in the within sample comparison for measure A above, but not for measure B. A The Wilcoxon signed rank and Wilcoxon rank sum tests lets me reject the hypothesis that the distribution of household WTP is equal the sum of the individual WTP of the households members for both the within and between sample comparison. For the one-person household comparison the Wilcoxon rank-sum test shows no significant difference in distribution for neither measure A or B, also lending some support to the above tests.

4.2.3. Respondent and Household Characteristics

I will now investigate whether household and respondent characteristics can help explain the relationship between household and individual WTP. The results from the multinomial logit regressions are shown in Table 10. In sample 1A, respondents with more than 2 years of university, the variable *Edu,* have a significantly lower probability[17] of stating $HWTP_i < IWTP_i$ compared to stating the same household and individual WTP. Also respondents with partners placing more than 50 percent of their income into joint household finances, the variable *Pincome_joint,* have a significantly lower probability of stating $HWTP_i < IWTP_i$ compared to stating equal household and individual WTP. Respondent that have a partner that make most of the everyday household choices, the variable *Partner_choices,* also have a significantly lower probability of stating $HWTP_i < IWTP_i$. The same results are obtained by respondents with a house close to any of the three ES valued, the variable *House*. The variable *Com_HH,* however, give a significantly higher probability of stating $HWTP_i < IWTP_i$ compared to stating equal WTP. For sample 1B, the variable *Female* give a significantly higher probability of stating a $HWTP_i < IWTP_i$. While the variables *Donate* and *Child,* indicating respondents who have donated some of their points earned during their time in Norstat to charity and respondents living with children under the age of 15, give a significantly lower probability of stating $HWTP_i < IWTP_i$ compared to stating equal WTP. Also, for sample 1B and the pooled sample, the interaction term with *Partner_choices* and *Female,* indicating female respondents with a partner making most of the everyday household choices, have a significantly lower probability of stating $HWTP_i < IWTP_i$. In the pooled sample, the variables *Pincome_joint* and *House* give a significantly lower probability of stating $HWTP_i < IWTP_i$, this is also observed for sample 1A. While the variable *Com_HH* give a significantly higher probability of stating $HWTP_i < IWTP_i$ compared to stating equal WTP. For sample 1A, the variable *Member,* indicating respondents that are members of an environmental or nature organization, give a significantly higher probability of stating $HWTP_i > IWTP_i$ compared to stating the same household and individual WTP. Respondents using any of the ES valued regularly for recreational purposes and respondents that mostly decided where the household should settle down, indicated with the variable *Use* and *Living,* also have a significantly higher probability of stating a $HWTP_i > IWTP_i$ compared to stating equal WTP.

[17] The coefficient in table 10 cannot be interpreted as a constant due to the non-linear form of the logit model. However, the coefficients' sign can be used to show the direction of the probability.

Table 10. Multinomial logit model on HWTP<IWTP, HWTP=IWTP or HWTP>IWTP

Independent variables	Sample 1A Coefficient	z-score	Sample 1B Coefficient	z-score	Pooled sample (1A+1B) Coefficient	z-score
y=1 (HWTP<IWTP)						
Age	0.001	0.03	0.001	0.01	0.000	0.00
Female	0.095	0.17	1.244*	1.67	0.448	0.98
Edu	-0.779*	-1.75	0.234	0.38	-0.250	-0.68
Member	-0.251	-0.28	-1.024	-0.82	-0.626	-0.97
Use	1.194	1.12	1.229	0.73	1.091	1.48
Donate	-1.352	-1.15	-13.775***	-10.38	-1.473	-1.30
Married	-0.392	-0.57	-0.594	-0.62	-0.518	-1.10
Hh_inc	-0.375	-0.54	-0.162	-0.24	-0.210	-0.47
Child	0.546	0.82	-1.499**	-2.14	0.028	0.06
Bank_account	0.181	0.23	0.723	0.95	0.265	0.55
Pincome_joint	-2.040***	-3.22	-0.950	-1.36	-1.461***	-3.23
Choices	0.125	0.11	-0.023	-0.03	0.037	0.06
Investment	-0.816	-0.71	-0.420	-0.46	-0.630	-1.00
Recourses	-0.288	-0.42	-0.535	-0.74	-0.541	-1.08
Property	-0.478	-0.59	0.140	0.14	-0.066	-0.11
Living	0.367	0.49	1.177	1.56	0.584	1.13
Partner_choices	-14.219***	-13.20	1.283	0.89	-0.204	-0.18
Partner_choices x Female	0.420	0.21	-16.808***	-10.00	-12.360***	-9.05
House	-0.966*	-1.68	-0.547	-0.73	-0.793*	-1.79
Com_HH	1.681**	2.28	0.696	0.64	1.049*	1.93
Constant	-1.658	-1.51	-3.758**	-2.26	-2.176***	-2.59
y=2(HWTP=IWTP)			Base outcome			
y=3 (HWTP>IWTP)						
Age	-0.008	-0.35	-0.009	-0.57	-0.009	-0.78
Female	0.421	0.67	0.357	0.81	0.329	1.04
Edu	0.153	0.26	-0.133	-0.35	-0.067	-0.23
Member	1.068**	1.97	0.289	0.63	0.623*	1.94
Use	1.856**	2.14	0.948	1.32	1.119**	2.16
Donate	-0.796	-0.73	0.654	1.13	0.042	0.09
Married	-0.778	0.67	0.536	1.48	0.053	0.14
Hh_inc	-0.929	-1.52	0.442	1.11	-0.014	-0.05
Child	-0.946	-1.39	0.457	0.94	-0.084	-0.24
Bank_account	0.250	0.42	-0.558	-1.18	-0.252	-0.74
Pincome_joint	0.093	0.16	0.214	0.49	0.184	0.59
Choices	0.680	1.00	0.725	1.32	0.763*	1.96
Investment	-0.909	-1.06	0.093	0.16	0.095	0.23
Recourses	0.423	0.52	-1.061*	-1.83	-0.734*	-1.85
Property	-0.868	-1.18	-0.128	-0.16	-0.408	-0.85
Living	1.336**	2.09	-0.688	-1.58	-0.076	-0.24
Partner_choices	-14.170***	-17.86	-1.477	-1.23	-1.494	1.078
Partner_choices x Female	-0.152	-0.09	-10.552***	-5.63	-10.446***	1.434
House	-0.220	-0.37	0.045	0.0.12	-0.069	-0.24
Com_HH	-1.326	-1.27	-0.185	0.49	-0.456	-1.07
Constant	-3.594**	-2.66	-2.103*	-1.76	-2.346***	-2.66
Log likelihood	-102.386		-121.444		-250.464	
Pseudo R	0.203		0.140		0.097	
N	238		204		442	

Note: *, **, *** indicates significance at 10%, 5%, and 1% levels, respectively. Robust standard errors in parenthesis

The variable *Partner_choices*, indicating respondents with partners making most of the everyday household choices, give a significantly lower probability of stating $HWTP_i > IWTP_i$ compared to stating the same household and individual WTP. For sample 1B, the variable *Recourses*, indicating respondents with most of the responsibility for allocating household resources, give a significantly lower probability of stating $HWTP_i > IWTP_i$ compared to stating equal WTP. For sample 1B and the pooled sample, the interaction term indicating female respondents with a partner making most of the everyday household choices also give a significantly lower probability of stating $HWTP_i > IWTP_i$ compared to stating the same household and individual WTP. In the pooled sample, the variables *Member* and *Use* give a significantly higher probability of stating $HWTP_i > IWTP_i$. Also, the variable *Resources,* indicating respondents that have most of the responsibility for resource allocation in the household, give a significantly lower probability of stating $HWTP_i > IWTP_i$. The variable C*hoices*, indicating respondents making most of the everyday household choices give a higher probability of the stating $HWTP_i > IWTP_i$.

4.2.4 Robustness

The results presented in the previous section are based on data where protesters have been removed and the remaining DK-responses have been recoded to zero-values. Consequently, it is interesting to investigate how sensitive the results are to this data treatment. Two common ways to handle DK responses are either to take them out of the sample or to treat them as opposers with a WTP of zero (Carson & Hanemann, 2005). Before the data treatment of the protest answers in sample 1A and 1B, 13 percent of the respondents gave at least one DK response and 22 percent of respondents gave at least one zero response when asked to state their household and individual WTP. 34 percent of the respondents give a zero and/or DK response to at least one of the WTP questions. The data treatment applied in the main analysis treats 75 percent of these respondents as protesters and remove them from the samples, while the remaining 25 percent are treated as legitimate responses and are not removed. I conduct a robustness check of the annual mean WTP with the two other options of data treatments suggested above. These treatments leave all the zero responses in the data, and either set all DK responses to zero or remove them from the data. Removing respondents with "protest" responses reduces the sample by 25 percentage points, while removing all respondents with DK responses only reduces the sample by 13 percentage points. Treating the DK responses as opposers increases the number of zero responses a great deal. The two alternative treatments of

DK responses are more conservative than the treatment done in the main analysis as these treatments increases the number of zero responses compared to what is found in the main analysis. This is confirmed in the Figure 8 andFigure 9 in the appendix. Using an unpaired t-tests to test for differences in the means from the main analysis and from the two alternative treatments of the DK response. The tests show no significant differences in mean WTP from the main analysis and the mean WTP where DK responses have been removed. While the differences in mean WTP from the main analysis and the mean WTP where DK responses are set to zero show some significant differences, but not in all cases. So, it seems like the annual mean WTP in the main analysis is slightly sensitive to the data treatment of the protest responses. It is often preferred to follow the more conservative approach in economic valuations so that the value of the good is not overestimated. However, in this case I have information on protest responses and I see it at most useful to remove these from the sample. This is also supported in the literature. Also, the pattern of the stated household and individual WTP for the two samples in the two alternative treatments of DK responses are similar to the pattern in in the treatment.

Table 12 in the appendix show how sensitive the multinomial logit regressions are to the alternative DK treatments. The multinomial regression with the two alternative treatments of the DK responses show few differences from the main analysis, but there are some differences worth noticing. The first difference is that the variable *House* show no significant results for neither sample 1A or the pooled sample, while the same variable in the main analysis give a significant lower probability of respondents stating a household WTP lower than their individual WTP compared to stating equal household and individual WTP. Also, for sample 1A in the main analysis, the variable *Edu* gives significantly lower probability, and the variable *Com_HH* give significantly higher probability of stating household WTP lower than individual WTP compared to stating equal WTP. These effects are not observed when DK responses are removed. Table 13. Robustness household and individual WTP - restricted model explores how sensitive the results in the main analysis are to the inclusion of other variables. In the restricted model, I find that respondents in sample 1A with a household WTP lower than their individual WTP no longer have significant results for the variable *Edu*, instead these respondents have significantly lower probability of stating a household WTP lower than their individual WTP if they are married. Married respondents in the pooled sample also have a significantly lower probability of stating their household WTP lower than their individual WTP. Respondents living with children in sample 1B no longer have a significantly lower probability of stating a household WTP lower than their individual WTP in the restricted model. Female respondents

in sample 1B and the pooled sample in the restricted model have a higher probability of stating household WTP higher than their individual WTP compared to stating equal WTP, this is not observed in the main analysis.

4.3 Spatial Characteristics, NEP and Altruistic Motivation

In this section I will investigate the effect spatial characteristics, environmental attitudes and altruistic motivations have on the stated household WTP for measure A. The results from the tobit regression are shown in Table 11. As one can expect, many of the sociodemographic characteristics gave significant results. The group variable *region*, indicating which region in Norway the respondent live, also give some significant results. Respondents living in both *Sørlandet including Telemark* and *Oslo* have a significantly higher household WTP for measure A compared to respondents living in Nord-Norge[18]. Furthermore, the usage of one of ES valued have an effect on the stated WTP, the variable *Use_pasture_land* give a significant higher household WTP for measure A. The variable *House_natural_forest*, indicating respondents having a house or a cabin less than 500 meters from pasture land reforested with natural forest, also give a significant higher WTP for measure A. Rural respondents in the bottom 20th percentile of the categorical variable *Centrality_index*, have a significant higher WTP for measure A compared to the respondents in the middle 60th percentile of the *Centrality_index*. Respondents in the top 20th percentile of the *Centrality_index*, have a slightly higher WTP for measure A, but this result is not significant. The variable *Population_density* seems to not have an impact on the stated WTP. Respondents within the top two quartiles of the variable *NEP_score* and the top tertile of the variable *Altruism_score* have a significant higher WTP for measure A. The variable *Donate*, which also give an indication of the altruistic motivation of the respondent, give a significant higher WTP for measure A. The variable *Pro_climate_forest*, which contribute to explaining the respondents environmental preferences, have no significant effect on the stated WTP. To see whether there is a variation in attitudes between urban and rural dwellers and if these can be explained by environmental attitudes and altruistic motivations, I included interaction terms. These gave few, but one interesting result. Respondents within the bottom 20th percentile of the *Centrality_index* and within the top quartile of the variable *NEP_score* have a significant lower WTP for measure A.

[18] The coefficients in the tobit regression models cannot be interpreted as a constant due to the non-linear form of the model. Nevertheless, the coefficients' signs shows the direction of the effect.

Table 11. Tobit regression on factors explaining the WTP for measure A and B

Variables (comparison group in brackets)	Measure A	
	WTP	Robust St. Error
Age	7.482***	2.407
Female	-185.223**	76.506
HH_income	74.370	92.077
Education	210.992***	79.277
Sentrality_index (middle 60 percentile)		
Bottom 20th percentile	525.265**	237.622
Top 20th percentile	18.184	232.843
Region (Nordland)		
Midt-Norge	77.209	141.512
Vestlandet	248.287	163.272
Østlandet	259.037	162.784
Sørlandet including Telemark	531.290***	192.942
Oslo	484.700*	262.985
Pop_density	0.026	0.117
House_climate_forest	13.482	91.824
Househ_natural_forest	182.587**	90.192
House_pasture_land	-10.746	86.715
Use_climate_forest	132.274	100.779
Use_natural_forest	-142.092	96.415
Use_pasture_land	209.498**	97.049
Pro_climate_forest	30.549	82.372
NEP score (bottom quartile)		
2nd quartile	89.705	136.100
3rd quartile	281.040**	123.997
Top quartile	447.564***	147.637
Donate	339.272***	115.471
Altruism score (bottom tertile)		
2nd tertile	145.405	111.706
Top tertile	295.143**	122.615
Sentrality_index (middle 60 percentile) x NEP_score (bottom quartile)		
Bottom 20th percentile x 2nd quartile	-106.278	307.082
Bottom 20th percentile x 3rd quartile	-131.135	289.429
Bottom 20th percentile x Top quartile	-545.047*	298.812
Top 20th percentile x 2nd quartile	10.353	209.806
Top 20th percentile x 3rd quartile	-287.253	232.208
Top 20th percentile x Top quartile	109.708	290.176
Sentrality_index (middle 60th percentile) x altruism_score (bottom tertile)		
bottom 20 percentile x 2nd tertile	-248.733	229.356
bottom 20 percentile x top tertile	-73.316	276.895
Top 20 percentile x 2nd tertile	-155.740	203.150
Top 20 percentile x top tertile	-116.396	252.747
Constant	-639.585***	215.154
pseudolikelihood	-5497.351	
Pseudo R2	0.01	
N	749	

Note: *, **, *** indicates significance at 10%, 5%, and 1% levels, respectively. Robust standard errors in parenthesis

4.3.1 Robustness

I will now investigate the robustness of the results from the tobit regression by applying the two common options of treating DK responses, either take the DK responses out of the sample or treat them as opposers and set their WTP to zero. The respondents with zero responses are left in the sample in these alternative treatments of DK responses. I will also run a restricted model to see whether some of the variables included in the tobit model sensitive to the inclusion of other variables. Before the data treatment of the protest responses done in the main analysis, 17 percent of the respondents gave a DK response to at least one of the WTP questions and 19 percent of respondents stated a zero response to at least one of the WTP questions. 35 percent of the respondent gave a zero and/or DK response to at least one of the WTP questions, 69 percent of these respondents were categorized as protesters in the main analysis and removed. The results from the tobit regression where the two treatments of the DK responses are applied are found in Table 14.The treatment of the DK responses give in some cases different results than the ones obtained to the main analysis, I will summarize the most important differences. Both where the DK responses are removed and where DK responses are set to zero, respondents defined as relatively positive to planting climate forest, the variable *pro_climate_forest*, have a significant higher WTP for measure A. The rural respondents in bottom 20th percentile of the *Centrality_index* obtained significant results where DK responses are set to zero, but not where DK responses are removed. The interaction term with respondents living in the most rural municipalities and have a NEP score within the top quartile no longer show significant results. As in the robustness check in the analysis on household and individual WTP, the data treatment of the protest responses is the least conservative data treatment option, this can possibly cause an overestimation of the welfare change. However, I see it as most useful to remove the protesters from the sample. The results from the restricted model is found in Table 15**Error! Reference source not found.** in the appendix. These results show that the variables included are not sensitive to the inclusion of other variables.

5. Discussion and Concluding Remarks

The following sections seeks to highlight some of the limitations of the survey and analysis, answer the research questions and give some concluding remarks.

5.1 Household and individual WTP

5.1.1 Limitations of the Survey and Analysis

Few respondents changed their stated WTP from the first to the second WTP question, especially compared to the Lindhjem and Navrud (2009) study. In the Lindhjem and Navrud (2009) study 32.6 percent of the respondents asked about their household WTP first and 53.9 percent of respondents asked about their individual WTP first stated a household WTP higher than their individual WTP. While in the present study only 9.5 percent of respondents in sample 1A (asked for household WTP first) and 21 percent of respondents in sample 1B (asked for individual WTP first) stated a household WTP higher than individual WTP for at least one of the measures. The fraction of respondents stating a household WTP lower than their individual WTP is higher among the respondents in the present study compared to the Lindhjem and Navrud (2009) study. In the present survey 9 percent in sample 1A and 5.5 percent in sample 1B have a household WTP lower than their individual WTP for at least one of the measures. While in the Lindhjem and Navrud (2009) study 7.9 percent of respondents asked about their household WTP first and 2.5 percent of respondents asked about their individual WTP first have a household WTP lower than their individual WTP. Still, the overall percentage of respondents changing their bid from the first to the second WTP question are lower compared to the Lindhjem and Navrud (2009) study. The reason for this is not immediately clear, but it is possible that the survey design is the cause. The present survey design might make it less likely that the respondent changes their answer from the first to the second WTP question. However, the survey states very clearly if the respondents should think about the household or only themselves when responding to the questions. In the second WTP question when the response unit is reversed, they are presented with their stated WTP in the first question and are asked if they now want to change this value. This should make it easy for the respondents to decide whether they want to change their answer, but this design might also make it easy for the respondents to state the same WTP and not consider the new situation presented thoroughly. The fact that so few respondents changed their stated WTP from the first to the second WTP question, give few observations when exploring whether respondent and household characteristics can be used to explain the relationship between household and individual WTP. Still, I found some trends within the samples.

The economic model of welfare measure indicates that the information the respondents have available (I in the model) will influence their stated WTP. It is therefore important that the

respondents are provided with a sufficient amount of information to be able to state a valid response. Presenting the respondent with an understandable and meaningful hypothetical scenario is an important part of this. If the survey fails to do so, the respondent are less likely to state a valid WTP, resulting in biased answers (Mitchell & Carson, 1989). Bateman et al. (2002) mentions several aspects important to think about when constructing the scenario presented to the respondents. The use of payment vehicle being one of them. The payment vehicle used in the survey is an increase in income tax. One can easily assume that most respondents are familiar with income taxes and it should therefore be possible for the respondents to familiarize themselves with the payment vehicle presented. Still, the literature have pointed out some issues with this type of vehicle. Bateman et al. (2002) argues that income taxes is a non-neutral payment vehicle as many people have negative associations to increased taxes. Respondents may therefore refuse to answer the WTP question on the grounds that they object to paying higher taxes, even when this increase in tax is associated with higher welfare. The use of taxes in a CV study also raises concerns around accountability, trust in the government, and that it is excluding to non-taxpayers. Also, compared to an earmarked tax, respondents might trust an increased income tax less as it is challenging to oversee what the increased income tax is used for. I removed respondents stating a zero WTP or answering DK in protest from the samples, but one cannot be sure that that the above problem is completely solved. Respondents providing a positive value when asked to state their WTP are not asked for their motivation to do so. Some respondents may have been affected by the income tax as payment vehicle when responding, resulting in biased estimations. Also, some people are exempted from paying income taxes, in this case, the hypothetical scenario presented to the respondents is not realistic and might affect the way they respond to the WTP questions. Hasler, Jacobsen, Lundhede, Martinsen, and Thorsen (2008) also points out some issues with using an income tax as payment vehicle. Income tax should be an easy and understandable payment vehicle when respondents are asked for their individual WTP, as they individually pay the increased income tax from the income they receive. The payment vehicle seems to be less understandable when respondents are asked to state their household WTP. Hasler et al. (2008) finds that when respondents answer a question concerning which payment unit they had based their choice of WTP, many respondents answered the question wrongly, especially among the respondents asked to state their household WTP. Only 34 percent correctly stated that the increase in income tax referred to an increase in the household's total income tax, while 73 percent of respondents asked to state their individual WTP correctly stated that the tax increase referred to an increase in individual tax payment. When the present survey asks the respondents

to state their household WTP it explicitly says that the increased income tax will affect both the respondent and their partner. Although, it is possible that the respondent misinterprets the question affecting their stated WTP for the household.

The robustness checks show that some of the results obtained when exploring whether household and respondent characteristics can explain some of the observed relationship between household and individual WTP are sensitive to the data treatment and the inclusion of other variables. However, many of the results are robust, especially the results for the variables describing the household structure.

5.1.2 Evaluation

I. Do respondents within the same sample change their WTP when the response unit is reversed in terms of whether they are asked for household or individual WTP, and what are their underlying reasons for doing so?

Few respondents changed their stated WTP from the first to the second WTP question, indicating that most respondents do not differentiate between household and individual WTP. Therefore, aggregating the annual mean individual WTP over adult individuals in Norway will cause an overestimation of the total welfare change, while aggregating the annual mean household WTP over households in Norway will possibly cause an underestimation of the total welfare change. The respondents that did change their bid form the first to the second WTP are more likely to state a household WTP higher than their individual WTP. Although, the respondents in sample 1B did so more frequently than the respondents in sample 1A. 21 percent of respondents in sample 1B, the respondents first asked to state their individual WTP, increase their bid from the first to the second WTP question for at least one of the measures. While only 9 percent of respondents in sample 1A, the respondents first asked to state their household WTP, reduced their bids from household WTP to individual WTP. These results are similar to what is found in Lindhjem and Navrud (2009). Lindhjem and Navrud (2009) suggests that a possible reason is that respondents asked for their household WTP first interprets the household WTP question as an individual WTP question, and therefore saw no reason to reduce the bid in the second WTP question. This argument is supported by Delaney and O'Toole (2008) who found that 27.8 percent of the respondents asked to state their household WTP instead stated their individual WTP indicating that respondents easily misinterprets the question even when the response unit is clearly stated. The CV literature have also found that the value placed on a

nested sequence of environmental goods are sensitive to the order in which the goods are presented, known as ordering effects. Typically, the whole of the good (HWTP) is valued higher if respondents are presented with the smaller part of the good (IWTP) first (Clark & Friesen, 2008). This phenomenon explains why a higher fraction of respondents asked about their individual WTP first increase their bid when asked to state their household WTP.

I observe no noteworthy differences in patterns in respondents changing their WTP from the first to the second WTP depending on the measure, except respondents in sample 1A when asked about measure B. In this case, sample 1A increase their bid from household WTP to individual WTP more frequently than they reduce their bid when they are asked to state their WTP for measure B. For sample 1A measure B, 21 respondents stated a household WTP lower than their household WTP, while only 16 respondents stated a household WTP higher than their individual WTP. While for measure A, 20 respondents state a household WTP higher than their individual WTP, while only 7 respondents state a household WTP lower than their individual WTP. The reason for this is not clear. Respondents in sample 1A stated that they are negative towards planting climate forest, it is therefore possible that they have a higher personal preference compared to the other household members towards measure B which mainly focuses restoring abandoned pastures and that this causes them to state their individual WTP higher than their household WTP. If this is the case I should observe the same trend in sample 1B, this is not the case.

The respondents stating a household WTP higher than their WTP rated their most important reason for doing so that they took both their own and the partners' income into consideration when responding to the household WTP questions. Respondents stating their household WTP lower than the individual WTP rated their most important reason for doing so that they were able to pay more when they were not thinking about the household. These results indicates that the respondents that change their bid from the first to the second WTP question don't seem to take the in income of their partner into their budget constraint when answering the individual mmWTP question. However, most respondents did not change their bid from the first to the second WTP. These respondents rated their most important reasons for doing so that their wish corresponds with the wish of the household, both pay the extra income tax and that even though they are asked to state their individual WTP they are not independent people. These results indicates a unitary household model where the respondents have their partners' income as a part of their own budget constraint and that they exhibit benevolent altruism towards the other members of the household. Most respondents did not change their bid from the first to the second WTP question, therefore it seem like the unitary household model applies for most of

the respondents, at least from their perspective. This indicates that aggregating the mean household WTP over households in Norway might be the best option, but also here there are some issues. The literature show that even when respondents try to accurately predict their partner's preference, they often fail. It is therefore not possible to know whether the respondents' stated household WTP is the true household WTP. More research is needed on the subject to know whether respondents' stated household WTP accurately represent the true household WTP and whether the respondents' stated household WTP can be aggregated over households to obtain accurate estimates of welfare change.

II. What is the observed relationship between the annual mean household WTP and the annual mean individual WTP, and can household and respondent characteristics be used to explain the observed relationship between household and individual WTP?

The comparison of annual mean household and annual mean individual WTP also gives an indication that aggregating the mean WTP over the wrong response unit will lead to wrong estimations of the total welfare change. The between sample comparison in the Lindhjem and Navrud (2009) study show no significance difference in mean, while I obtain different results for the two measures. I find that the mean Individual WTP in sample 1B is not significantly different from the mean household WTP in sample 1A for measure B. While for measure A, respondents in sample 1A have a significantly higher mean household WTP compared to the mean individual WTP in sample 1B. For the Wilcoxon rank-sum test, I find that I can reject the null hypothesis for measure B, but not measure A. This gives some support to the results obtained in the between sample comparison with the Welsh's t-test. Lindhjem and Navrud (2009)'s within sample comparison show that household WTP is higher than individual WTP for both samples, while I again obtain different results for the two measures. For measure A, I find that sample 1A have a significant higher household WTP compared to their individual WTP. While for sample 1B, the household and individual WTP is equal. For measure B, the opposite are observed. Sample 1B have a significant higher household WTP compared to their individual WTP. While for sample 1A, these are equal. According to the ordering effect, sample 1B should to a larger extent state a household WTP higher than their individual WTP compared to sample 1A, this is not the case. Sample 1B have a mean household WTP higher than their mean individual WTP for measure B, while sample 1A have a mean household WTP higher than their mean individual WTP for measure A. So, respondents in sample 1B does more frequently state a household WTP higher than their individual WTP, but the increase in their

WTP does not seem to be substantial. The results from the Wilcoxon signed-rank test give some support to the results obtained in the within sample mean comparison for sample 1A and sample 1B measure A, but not sample 1B measure B. The results from the between sample and within sample mean comparisons indicates that the how respondents state their individual and household WTP depend on the measure presented, but overall, only hypothesis H1 and H2 in Table *1* are supported. Also, when the mean household WTP is significantly higher than individual WTP the difference is not substantial. This indicates that in most cases aggregating the mean individual WTP over adult individuals will cause an overestimation of the welfare measure. This is also supported by the rejection of hypothesis H4 in both the between and within sample comparison in Table *1*, where the mean annual household WTP is equal to the sum of the WTP of the individuals in the household.

Comparing the household and individual WTP for one-person households, I find with a Welch's t-test that there is no significant difference in annual mean. The Wilcoxon test also shows that the null hypothesis of equal distribution cannot be rejected. The single respondents living alone should have no difference in WTP depending on whether they are asked to state their individual or household WTP, these results therefore show that how the question is formulated does not affect the WTP for singles living alone.

The multinomial logit regression found in Table 10 investigates whether household and respondent characteristics can be used to explain the observed relationship between individual and household WTP. The analysis places significant weight on investigating whether the structure of the household can be used to explain the observed relationship. The results show that whether the respondent have a joint bank account with their partner have no significant effect on the relationship between household and individual WTP. It is rather the amount of the partner's income that go into joint finances that have significant effect. For sample 1A and the pooled sample, respondents with partners that put more than 50 percent of their income into joint household finances have a significant lower probability of stating a household WTP lower than their individual WTP compared to stating equal household and individual WTP. This lends some support to Munro (2005) who argues that if income pooling is satisfied household WTP and individual WTP should be equal. Also, Delaney and O'Toole (2008) finds that respondents that are a part of households where finances are conducted jointly are more likely to respond as households when the response unit is not specified, indicating that these respondents perceives the household as more tightly integrated when finances are conducted jointly. Respondents in sample 1A with partners that makes most of the everyday household decisions have a

significantly higher probability of stating equal household and individual WTP. In sample 1B and the pooled sample, female respondents with partners that make most of the everyday decisions in the household have a significantly higher probability of stating equal household and individual WTP. The reason for this might be that the respondents with partners making most of the everyday decisions are not used to making decisions on behalf of the household and therefore the "easy" solution is to state equal household and individual WTP. The results for sample 1A show that respondents that mostly decided where the household should settle down have a higher probability of stating household WTP higher than their individual WTP. In the pooled sample, the respondents who makes most of the everyday decisions also have a higher probability of stating their household WTP higher than their individual WTP. Both indicating that the respondents used to making decisions on behalf of the household state their household WTP higher than their individual WTP, this might be because they are more aware of the preferences of the household compared to their own preferences. For sample 1B and the pooled sample, respondents that have most of the responsibility of allocating household resources are more likely to state equal household and individual WTP compared to a stating household WTP higher than their individual WTP. The reason for this might be that respondents controlling the resources feel more obliged to use the resources of the household they way that best benefits the household, even when they are asked about their personal preferences. Other characteristics also give significant results. The results for sample 1A and the pooled sample show that respondents that communicated with other in the household during taking the survey are significantly more likely to state their individual WTP higher than their household WTP. The reason for this might be that the respondents become more aware of the different preferences while communicating with the other members of the household. Surprisingly, the female respondents in sample 1B have a higher probability of stating their individual WTP higher than their household WTP, these results are a contrast to what is found in Lindhjem and Navrud (2009), they find that female respondents are more likely to state equal household and individual WTP. The results for sample 1B show that respondents with a higher degree on altruism (measured by whether they give to charity) have a significantly higher probability of stating equal household WTP compared stating their household WTP lower than their individual WTP. This result give some support to the unitary model where one of the assumptions is that the respondents have benevolent altruism towards the other household members causing them to exhibit the same preferences on behalf of themselves and on behalf of the household. The support given to the unitary model assumes that the respondents giving to charity are altruistic individuals that also have benevolent altruism towards the other

members of the household. The results for sample B also show that respondents living with children have significantly higher probability of stating equal household and individual WTP compared to stating individual WTP higher than their household WTP. This result give some support to Lindhjem and Navrud (2009) . Living with children might make the household more tightly integrated causing the respondent to exhibit the same preferences on behalf of themselves and the household. The regression for sample 1A and the pooled sample show that respondents that are members of an environmental or nature organization and respondents using one of the ES valued regularly for recreational purposes have a significantly higher probability of stating a household WTP higher than individual WTP compared to stating equal household and individual WTP. This might indicate that the respondents have a higher interest for the ecosystems valued compared to the other household members. When they add their own interest on top of the interest of the household, the household WTP becomes higher than their individual WTP. Also respondents in sample 1A and in the pooled sample with a house less than 500 meters from the one of the ES valued have a significantly lower probability of stating individual WTP higher than household WTP, this might be because the respondent and the household is more familiar with the ES valued and therefore the respondents believe that the opinion of the household is similar to their own. Respondents in sample 1A with more than two years in university are less likely to state a household WTP lower than individual WTP, These results show that it is possible to explain some of the observed relationship between household and individual WTP with household and respondent characteristics. Being aware of the characteristics that influences how the respondents answer the household and individual WTP question is useful when deciding which response unit one should use in a CV study. These characteristics also can contribute to explaining how the respondents view the WTP questions. However, more research is needed to obtain a clearer picture of the how the characteristics affect the stated household and individual WTP. The topic of individual and household WTP also needs to be thoroughly investigated and tested before one can give a clear recommendation on which response unit to use in CV surveys.

5.2 Spatial Characteristics, NEP and Altruistic Motivations

5.2.1 Limitations of the Survey and Analysis

The limitations of using an increased income tax as payment vehicle are also valid in the analysis of research question (III) where I investigate whether spatial characteristics, environmental attitudes, and altruistic motivations affects the valuation of ES.

I obtain a pseudo R-squared of 0.01 in the tobit regression, this is considered low. The tobit model is therefore not fitted to do precise estimations, but it still picks up significant trends in the data which was the goal of the analysis.

The robustness check with the alternative treatments of the DK responses changes the significance on a few of the variables compared to the main analysis. This indicates that some of the trends picked up in the main analysis is sensitive to the data treatment of the protest responses. One of the main things to notice is that that the significant result obtained for rural respondents are somewhat sensitive to the data treatment of "protest" responses. The rural respondents only have a significant higher WTP for measure A at a 10 percent level where DK responses are set to zero, and does not show a significant results when DK responses are removed. Also, respondents defined as relatively positive towards planting climate forest have a significant higher WTP for measure A in both of the alternative treatments to the DK responses. This gives an indication that the respondents' stated opinion about climate forest is sensitive to the data treatment. Overall, the robustness analysis show that some variables are sensitive to the data treatment done in the main analysis, but the main part of the results remain the same.

5.2.2 Evaluation

III. Can spatial characteristics, environmental attitudes and altruistic motivations be used to explain the stated amount of household WTP for measure A? And can altruistic motivations and environmental attitudes be used to explain some of the differences between urban and rural respondents?

The findings in the tobit regressions are in many cases supported by what is previously justified in the literature. The respondents living in the regions *Sørlandet including Telemark* and *Oslo* have a significant higher WTP for measure A compared to respondents living in the region *Nord-Norge*. The two spatial effects, spatial dependence and spatial heterogeneity, can both be the reason for the significant.. According to spatial dependence, respondents living within

closer proximity to each other are more likely to have similar opinions compared to respondents living further away from each other, causing spatial clusters. These clusters might cause respondents living within the regions *Sørlandet including Telemark* and *Oslo* to have a significant different WTP for ES compared to respondents living in *Nord-Norge*. Spatial heterogeneity occurs as a consequence of regional differences following from the inherent uniqueness of each location. Respondents in the same region is used to being surrounded by the same ecosystems and this may affect their WTP for the ES in measure A. *Oslo* and *Sørlandet including Telemark* are two regions with more densely planted forests compared to Nord-Norge (Grimsrud et al., 2020), respondents within these regions are therefore more familiar with this type of ecosystem which might lead them to state a higher WTP for measure A consisting of planting some climate forest. The fact that respondents more familiar with the good valued have a higher WTP for the same good is supported in the literature (see e.g. Faccioli et al. (2020) and Budziński et al. (2018)). I have controlled for demographic factors, other geographic factors, environmental attitudes and altruistic motivations in the regression. However, the region variables might pick up some effects that are not controlled for in the regression. The distance decay effect, as the literature shows, might also cause respondent living closer to the ecosystem valued to have a different WTP for the ecosystems compared to respondents living further away. I control for this in the regression and find that respondents that have a house or a cabin within 500 meters of pasture land reforested with natural forest have a higher WTP for measure A. This indicates that respondents that have experience with abandoned pastures have a significant higher WTP for measures using the land for alternative purposes. Rolfe and Windle (2012) finds in their study that some of the distance decay effect can be explained by the usage of the good rather than proximity to the good valued, I therefore also control for usage of the ecosystems valued. It is interesting to see that respondents using pasture land regularly for recreational purposes have a significant higher WTP for measure A, which mainly focuses on restoring abandoned pasture land. The literature have proven that urban and rural dwellers often have different opinions towards ES, I therefore also explore this in the regression. As respondents are not asked to value only one ES, but rather a measure consisting of multiple ES that have different advantages and disadvantages, it is difficult to predict how urban and rural respondents will value this measure. The urban population have been shown to prefer nature conservation. Also, Bergmann et al. (2008) have found that the urban population prefers projects that do not generate air pollution. This could mean that the urban population would have a high WTP for measure A, since it consist of preservation of biodiversity in the form of restoring pasture land and CO^2 sequestration in the form of planting climate forest. However,

Olive (2014) finds that Canadian farmers have more awareness of endangered species and conservation policies than urban Canadians. This might cause the rural respondents to have a significantly higher WTP measure A, which focuses on restoring abandoned pastures leading to preservation of biodiversity. Rural dwellers are also shown to be more in favor of using land, especially when it creates jobs and contributes to their livelihood (Bergmann et al., 2008; Silva et al., 2017). This might cause rural respondents to be more in favor of any measure using the abandoned pastures for alternative purposes, because using the land is better than letting it grow into natural forest. The results from the tobit regression shows that rural respondents have a significant higher WTP for measure A compared to the respondents within the middle 60th percentile of the *Centrality_index*. The urban respondents have a slightly higher WTP compared to the respondents within the middle 60th percentile of the *Centrality_index*, but these results are not significant. People with a high NEP score is shown in the literature to have a higher WTP for ES (Johnston et al., 2017), this agrees with what I find in my analysis. Respondents with a high NEP score have a significant higher WTP for measure A compared to respondents in the bottom quartile. The variable *Pro_climate_forest* indicates whether respondents are relatively positive to planting climate forest to tackle climate change or relatively negative to planting climate forest to preserve endangered species. Measure A both help tackle climate change by planting climate forest and preserve endangered species by restoring pasture land, it is therefore not clear how the *Pro_climate_forest* variable will influence the WTP for measure A. The results from the tobit regression show that the variable *Pro_climate_forest* have a slight positive effect of the WTP, but this effect is not significant. Altruistic motivations are also shown in the literature to have a positive effect on the valuations of environmental goods (Liebe et al., 2011), this is confirmed in the analysis where respondents with an altruism score in the top tertile have a significant higher WTP for measure A compared to respondents within the bottom tertile. Whether the respondents have donated some of the points earned to charity while being a member of the Norstat panel also give an indication of the respondents' altruistic motivations. The variable *Donation* give a significant higher WTP for measure A. I also included interaction terms to investigate whether some of the differences between urban and rural dwellers could be explained by differences in environmental attitudes and altruistic motivations. The interaction terms give few results indicating that the difference between urban and rural respondents cannot be explained by these factors. One significant result was obtained and it show that the rural respondents with a NEP score within the top quartile have a significant lower WTP for measure A. The logic behind this is not clear, it is possible that rural respondents with a high NEP score are both in favor of preservation (Dunlap et al., 2000) and are more

aware of endangered species (Olive, 2014), causing them to have a lower WTP for measure A which uses some of the land to planting climate forest proven to raise the number of endangered species. Overall, the results obtained supports much of what is previously justified in the literature. Spatial characteristic, environmental attitudes and altruistic motivations have an effect on the valuation of these ecosystem services. Controlling for these effects will therefore improve the welfare estimations in CV studies.

5.3 Concluding remarks

This thesis has investigated two methodological issues in CV of ES in Norway. The first issue is connected to the relationship between household and individual WTP in valuation of ES and whether some household and respondent characteristics can be used to explain the observed relationship. It is important to obtain a better understanding of this relationship because aggregating over the wrong response unit can cause considerable bias in the estimation of welfare change. The second issue is related to whether spatial characteristics, environmental attitudes and altruistic motivations affects the stated household WTP for ES and whether some of the observed differences between urban and rural respondents can be explained by environmental attitudes and altruistic motivations. Understanding these effects are important to be able to aggregate the correct WTP in economic analysis and to control whether peoples stated preferences in CV seems reasonable. The survey which the thesis is based on was conducted by Statistics Norway with collaboration in December of 2018 and January of 2019 and was answered by a representative sample of the Norwegian population. The survey asked respondents about their WTP for two measures dealing with the newly abandoned pasture land in Norway, where the measures consists of planting climate forest to tackle climate change or restoring the abandoned pastures which is good for preserving abandoned pastures.

Most respondents stated the same household and individual WTP. Their underlying reasons[19] for doing so indicates a unitary household model from the point of view of the respondents. Also, I find that respondents either state a household WTP higher than their individual WTP or they state their household equal their individual WTP depending on the measure presented. Most respondents does not change their stated WTP from the first to the second WTP question, indicating that aggregating the annual mean individual WTP over adult individual in Norway will cause an overestimation of the welfare change. The support given to the unitary model

[19] The most important underlying reasons were: the respondent's wish corresponds with the wish of the household, both pay the extra income tax and that even though they are asked to state their individual WTP they are not independent people

might indicate that aggregating the mean household WTP over household in Norway is the best option, but also here there are some issues. The literature show that even when respondents try to accurately predict their partner's preference, they often fail. It is therefore unknown whether the respondents' stated household WTP is the true household WTP. More research is needed on the subject to give a clear recommendation of which response unit one should use in CV studies. My findings when investigating how spatial characteristics, environmental attitudes and altruistic motivation affect the WTP for ES are to a great extent supported by what is previously justified in the literature. Both the distance and the usage of the service valued have an effect on the stated household WTP, similar to what is found in Budziński et al. (2018) and Rolfe and Windle (2012). I also found that the valuation of ES also depend on which region in Norway you live in. Also, being a rural respondent have an effect of the stated WTP, also justified in the literature (Bergmann et al., 2008). Also, environmental attitudes and altruistic motivations also have an effect on the stated WTP (Johnston et al., 2017; Liebe et al., 2011). Further, I found that environmental attitudes and altruistic motivations were not able to explain much of the differences between rural and urban respondents. However, spatial characteristics, environmental attitudes and altruistic motivations undoubtedly have an effect on the valuation of the ES studied in this thesis. Controlling for these effects in valuation of ES will therefore improve the welfare estimations in CV studies.

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7. Appendix

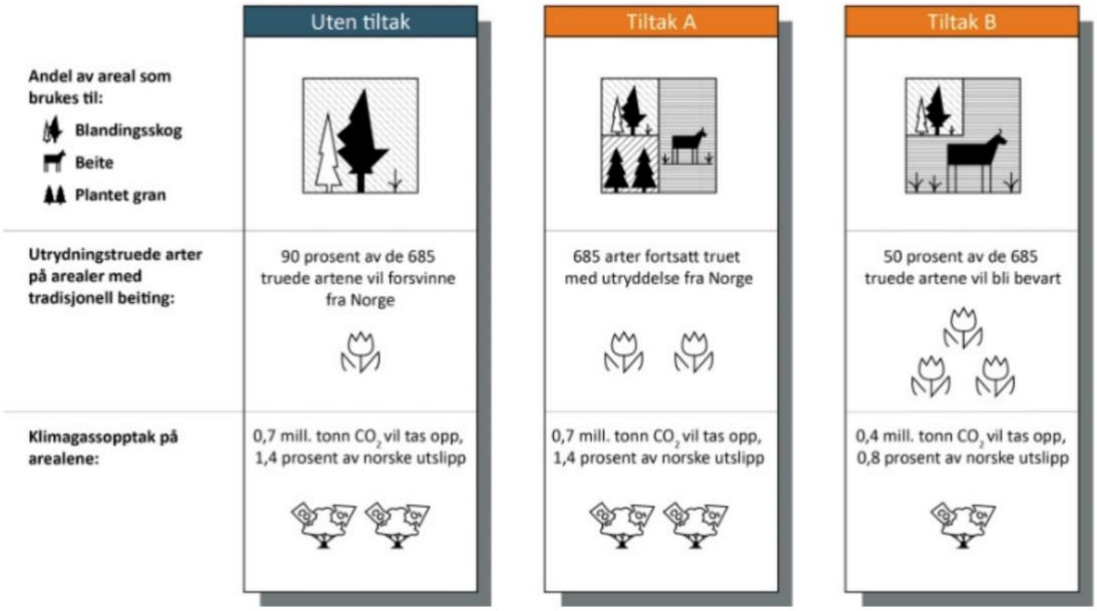

Figure 4. Measure A and B presented to sample 1A and 1B

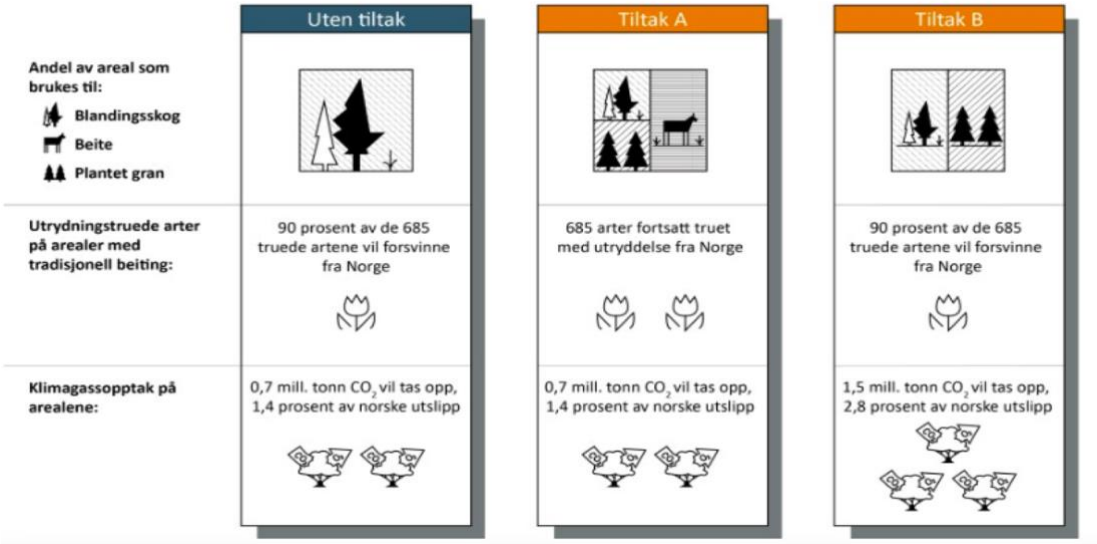

Figure 5. Measure A and B presented to sample 2

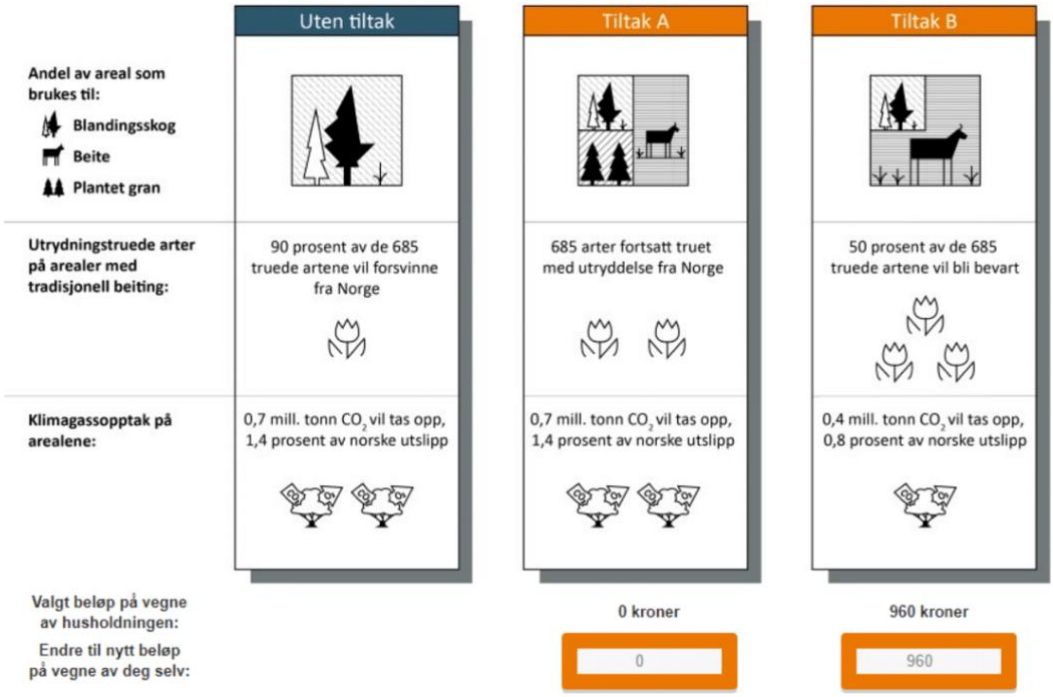

Figure 6. Payment card in second WTP question

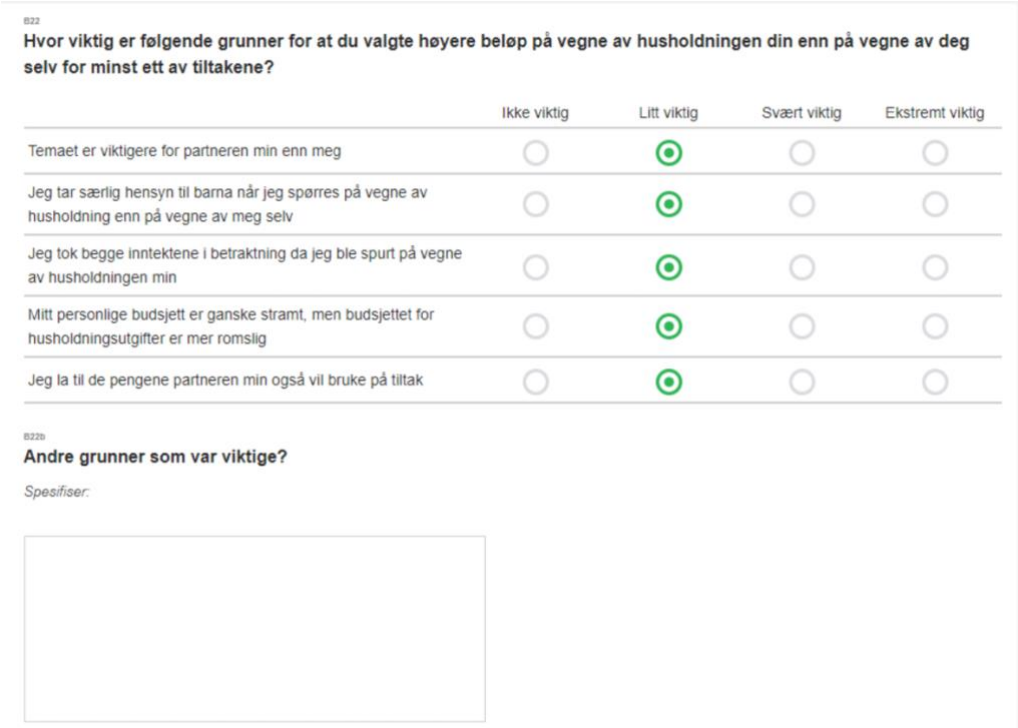

Figure 7. Setup for the given reason they are asked to rate[a]

[a] Shows the setup of the given reasons presented to the respondent depending on whether they state a higher, lower and/ or same household WTP compared to individual WTP. This figure shows the stated reason given to respondent stating a higher household WTP compared to individual WTP, but the set-up is the same for the two other cases.

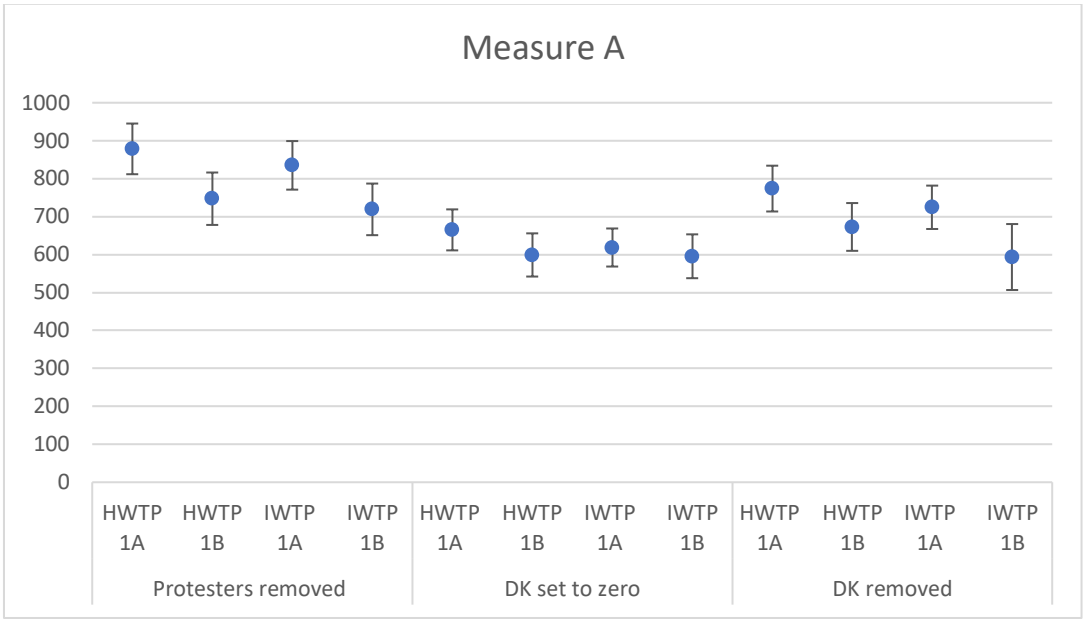

Figure 8. Sensitivity of the WTP for measure A

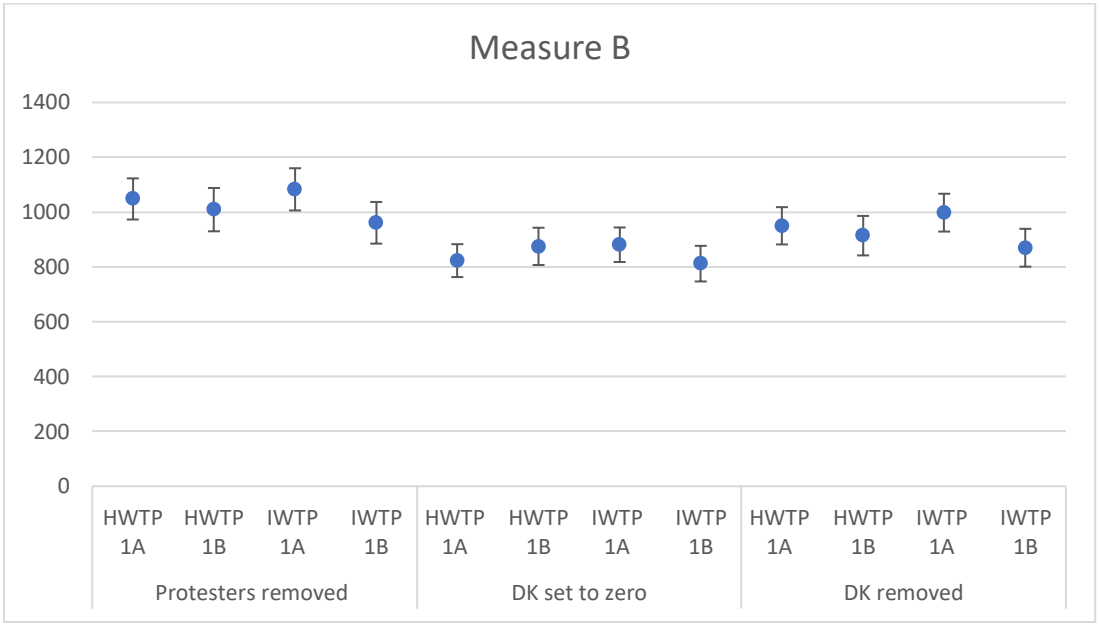

Figure 9. Sensitivity of the WTP for measure B

Table 12. Robustness household and individual WTP - DK treatment

	Sample 1A		Sample 1B		Pooled sample (1A+1B)	
Independent variables	DK removed	DK set to zero	DK removed	DK set to zero	DK removed	DK set to zero
Y=1 (HWTP<IWTP)						
Age	-0.025	-0.011	0.002	0.007	-0.016	-0.005
Female	0.230	0.347	1.539**	1.470**	0.508	0.581
Edu	-0.677	-0.724**	0.282	0.543	-0.294	-0.306
Member	-0.344	-0.572	-1.318	-1.501	-0.589	-0.747
Use	0.587	0.503	1.476	1.494	0.587	0.596
Donate	-0.887	-1.131	-14.297***	-14.570***	-1.126	-1.326*
Married	-0.313	-0.009	-0.593	-0.823	-0.225	-0.151
HH_inc	0.223	-0.027	-0.323	-0.488	-0.035	-0.129
Child	-0.110	-0.207	-1.832**	-1.161*	-0.298	-0.304
Bank_account	0.171	0.290	0.344	0.202	0.112	0.139
Pincome_joint	-1.260**	-0.853*	-0.808	-0.616	-1.000**	-0.729**
HH_choices	0.250	0.028	-0.534	-0.212	0.007	-0.055
HH_investment	-1.245	-0.702	-0.579	-0.408	-0.974*	-0.589
HH_recourses	0.258	-0.054	-0.078	-0.197	-0.010	-0.177
Property	-0.246	-0.047	-0.264	0.578	0.046	-0.031
Living	0.664	0.173	1.642	1.345**	0.777	0.353
Partner_choices	1.519	0.709	1.491	1.486	0.851	0.620
Partner_choices x Female	-14.994***	-14.99***	-18.191***	-18.379***	-12.441***	-13.866***
House	-0.512	-0.572	-0.436	-0.217	-0.509	-0.447
Com_HH	0.949	1.067*	0.347	0.790	-1.256*	0.843*
Constant	-0.227	-0.970	-4.235***	-4.683***	-2.176***	-1.842***
y=2(HWTP=IWTP)	Base outcome					
y=3 (HWTP>IWTP)						
Age	-0.004	-0.009	-0.001	0.001	-0.003	-0.003
Female	0.554	0.372	0.574	0.534	0.477	0.440
Edu	0.063	0.114	-0.170	-0.183	-0.153	-0.153
Member	0.931*	1.147**	0.300	0.207	0.554*	0.541*
Use	1.689*	1.780**	0.270	0.401	0.823*	0.854*
Donate	-0.732	-0.621	0.264	0.329	-0.111	-0.086
Married	-1.054	-0.776	0.402	0.200	-0.037	-0.093
HH_inc	-1.036	-1.021*	0.579	0.542	0.066	-0.954
Child	-0.914	-0.851	0.337	0.024	-0.145	-0.264
Bank_account	0.399	0.260	-0.439	-0.342	-0.084	-0.068
Pincome_joint	0.433	0.396	0.153	0.323	0.180	0.252
HH_choices	1.053	1.075	0.427	0.624	0.733**	0.842**
HH_investment	-0.725	-0.735	0.376	0.317	0.295	0.274
HH_recourses	-0.177	0.235	-0.998**	-0.904**	-0.887**	0.894**
Property	-0.509	-0.301	-0.133	0.146	-0.251	-0.038
Living	1.267**	1.066*	-0.714*	-0.539	-0.105	-0.105
Partner_choices	-12.931***	-12.835***	-1.454	-1.487	-1.401	-1.421
Partner_choices x Female	-0.554	0.088	-11.580***	-12.401***	-9.540***	-10.913***
House	-0.202	-0.114	-0.016	0.029	-0.100	-0.089
Com_HH	-1.880*	-1.602	-0.539	-0.363	-0.811*	-0.648
Constant	-3.624**	-3.740**	-1.943**	-2.204**	-2.389***	-2.534***
Log likelihood	-133.386	-161.195	-137.475	-156.478	-302.227	-349.713
Pseudo R	0.172	0.141	0.129	0.110	0.081	0.074
N	280	332	234	264	514	596

Note: *, **, *** indicates significance at 10%, 5%, and 1% levels, respectively. Robust standard errors in parenthesis

Table 13. Robustness household and individual WTP - restricted model

	Sample 1A		Sample 1B		Pooled sample (1A+1B)	
Independent variables	Coefficient I	Coefficient II	Coefficient I	Coefficient II	Coefficient I	Coefficient II
Y=1 (HWTP<IWTP)						
Age	-0.007	-0.002	0.013	0.010	-0.002	-0.003
Female	0.036	0.225	0.946	1.045	0.301	0.455
Edu	-0.585	-0.507	0.212	0.177	-0.239	-0.180
Member	-0.603	-0.412	-0.722	-0.710	-0.638	-0.589
Use	0.880	0.952	0.464	0.559	0.749	0.825
Donate	-1.386	-0.978	-14.265***	-13.424***	-1.449	-1.316
Married	-0.972*	-1.025*	-0.812	-0.672	-0.845*	-0.801*
HH_inc	-0.250	-0.356	0.099	0.025	-0.135	-0.235
Child	0.255	0.367	-1.447	-1.355	-0.126	0.001
Bank_account	-0.110	-0.072	0.721	0.732	0.134	0.127
Pincome_joint		-1.230**		-0.588		-1.068***
Choices		-0.300		0.170		0.010
Investments		-1.006		-0.001		-0.537
Recourses		-0.286		-0.698		-0.666
Property						
Living						
Partner_choices						
Partner_choices x Female						
House						
Com_HH						
Constant	-1.754	-1.344	-3.807***	-3.376***	-2.599***	-2.024***
y=2(HWTP=IWTP)	Base outcome					
y=3 (HWTP>IWTP)						
Age	-0.005	-0.008	-0.009	-0.011	-0.011	-0.012
Female	0.652	0.494	0.772**	0.460	0.649**	0.418
Edu	0.260	0.290	0.019	-0.073	-0.036	-0.028
Member	1.217**	1.072**	0.227	0.164	0.642*	0.581
Use	1.593*	1.550*	0.868	0.876	1.162**	1.114**
Donate	-0.558	-0.423	0.642	0.589	0.051	0.029
Married	-0.297	-0.241	0.504	0.532	0.220	0.191
HH_inc	-0.975	1.017	0.389	0.375	0.054	0.061
Child	-0.819	-0.946	0.372	0.436	-0.121	-0.157
Bank_account	0.348	0.439	-0.507	-0.634	-0.188	-0.213
Pincome_joint		-0.204		0.189		0.109
Choices		1.017		0.688		0.854**
Investments		-0.339		-0.090		-0.042
Recourses		-0.086		-1.217**		-0.810**
Property						
Living						
Partner_choices						
Partner_choices x Female						
House						
Com_HH						
Constant	-3.711***	-3.623***	-2.580**	-2.160*	-2.744***	-2.505***
Log likelihood	-115.594	-110.573	-130.892	-126.255	-264.241	-256.364
Pseudo R	0.100	0.139	0.073	0.106	0.048	0.076
N	238	238	204	204	442	442

Note: *, **, *** indicates significance at 10%, 5%, and 1% levels, respectively. Robust standard errors in parenthesis

Table 14. Robustness Tobit regression – DK treatment

	Measure A			
	DK removed		DK set to zero	
Variables (comparison group in brackets)	Coefficient	Robust st. error	Coefficient	Robust st. error
Age	8.360***	2.360	8.355***	2.429
Female	-103.606	73.856	-235.439***	76.965
HH income	43.902	87.888	45.232	90.059
Education	241.828***	76.179	254.468***	78.164
Sentrality_index (middle 60 percentile)				
Bottom 20th percentile	386.681*	235.079	382.299*	223.512
Top 20th percentile	-61.086	226.069	-36.879	228.686
Region (Nordland)				
Midt-Norge	125.733	138.933	114.388	137.613
Vestlandet	235.032	154.642	182.839	153.503
Østlandet	223.186	154.227	216.497	152.564
Sørlandet including Telemark	429.915**	185.590	465.261**	183.523
Oslo	589.997**	253.259	531.847**	254.717
Pop_density	-0.027	0.112	-0.021	0.117
House_climate_forest	18.643	88.014	-41.015	89.899
Househ_natural_forest	117.073	86.171	179.004**	86.819
House_pasture_land	1.290	84.838	47.612	84.511
Use_climate_fores	116.159	98.380	147.519	98.321
Use_natural_forest	-115.117	90.509	-84.323	94.093
Use_pasture_land	219.145**	94.180	284.221***	95.543
Pro_climate_forest	211.862***	81.204	228.698***	80.729
NEP score (bottom quartile)				
2nd quartile	64.668	133.087	83.076	133.696
3rd quartile	174.138	121.881	206.561*	124.854
Top quartile	419.040***	143.768	470.129***	152.985
Donate	426.658***	117.152	417.861***	417.861
Altruism score (bottom tertile)				
2nd tertile	125.689	110.073	186.991	118.799
Top tertile	316.512***	120.509	261.222**	121.297
Sentrality_index (middle 60 percentile) x NEP_score (bottom quartile)				
Bottom 20th percentile x 2nd quartile	15.935	297.266	-125.715	286.033
Bottom 20th percentile x 3rd quartile	35.330	280.163	14.081	264.550
Bottom 20th percentile x Top quartile	-433.693	289.826	-412.939	282.434
Top 20th percentile x 2nd quartile	-27.097	285.071	-60.568	282.515
Top 20th percentile x 3rd quartile	-176.144	231.555	-101.320	236.313
Top 20th percentile x Top quartile	211.605	287.419	286.648	288.212
Sentrality_index (middle 60th percentile) x altruism_score (bottom tertile)				
bottom 20 percentile x 2nd tertile	-183.424	225.856	-132.136	222.840
bottom 20 percentile x top tertile	-104.564	273.672	-0.870	258.923
Top 20 percentile x 2nd tertile	-352.707	214.531	-386.021*	227.456
Top 20 percentile x top tertile	-141.235	242.149	-196.251	236.697
Constant	-794.555***	209.323	-1078.25***	219.728
Pseudolikelihood	-5820.034		-6139.361	
Pseudo R2	0.011		0.013	
N	823		997	
N of zero responses	142		297	

Note: *, **, *** indicates significance at 10%, 5%, and 1% levels, respectively. Robust standard errors in parenthesis

Table 15. Robustness tobit regression -restricted model

Variables (comparison group in brackets)	Measure A[a] WTP I	WTP II	WTP III	WTP IIII
Age	9.180***	8.851***	7.663***	7.482***
	(2.41)	(2.436)	(2.439)	(2.407)
Female	-187.674**	-195.766**	-192.884**	-185.223**
	(81.256)	(80.710)	(77.109)	(76.506)
HH income	98.916	77.481	62.485	74.370
	(91.538)	(91.801)	(91.793)	(92.077)
Education	246.636***	246.961***	216.263***	210.992***
	(82.135)	(80.665)	(79.779)	(76.277)
Sentrality_index (middle 60 percentile)				
Bottom 20th percentile	188.393*	238.292*	258.070*	525.265**
	(113.284)	(135.638)	(134.466)	(237.622)
Top 20th percentile	68.103	-42.582	-79.581	18.184
	(103.059)	(173.579	(163.637)	(232.843)
Region (Nordland)				
Midt-Norge		89.850	69.897	77.209
		(145.084)	(143.233)	(141.517)
Vestlandet		265.190	231.224	248.287
		(165.634)	(162.734)	(163.272)
Østlandet		250.048	247.475	259.037
		(168.024)	(161.006)	259.037)
Sørlandet including Telemark		525.852***	521.851***	531.290***
		(202.184)	(196.934)	(192.942)
Oslo		562.968**	457.086*	484.700*
		(271.724)	(262.327)	(262.985)
Pop_density		-0.055	0.031	0.026
		(0.124)	(0.118)	(0.117)
House_climate_forest		42.968	4.843	13.482
		(91.970)	(92.995)	(91.824)
Househ_natural_forest		218.914**	195.238**	182.587**
		(90.229)	(89.880)	(90.192)
House_pasture_land		7.769	-23.159	-10.746
		(85.853)	(85.598)	(86.715)
Use_climate_forest			137.606	132.274
			(98.541)	(100.779)
Use_natural_forest			-132.137	-142.092
			(96.610)	(96.415)
Use_pasture_land			208.082**	209.498**
			(97.141)	(97.049)
Pro_climate_forest			38.937	30.549
			(80.927)	(82.372)
NEP score (bottom quartile)				
2nd quartile			79.561	89.705
			(115.933)	(136.100)
3rd quartile			196.576**	281.040**
			(98.049)	(123.997)
Top quartile			357.862***	447.564***
			(115.860)	(147.637)
Donate			340.414***	339.272***
			(116.935)	(115.471)
Altruism score (bottom tertile)				
2nd tertile			59.599	145.405
			(85.555)	(111.706)
Top tertile			256.498***	295.143**
			(104.197)	(122.615)

Sentrality_index (middle 60 percentile) x NEP_score (bottom quartile)				
Bottom 20th percentile x 2nd quartile				-106.278
				(307.082)
Bottom 20th percentile x 3rd quartile				-131.135
				(289.419)
Bottom 20th percentile x Top quartile				-545.047*
				(298.812)
Top 20th percentile x 2nd quartile				10.353
				(290.806)
Top 20th percentile x 3rd quartile				-287.253
				(232.208)
Top 20th percentile x Top quartile				109.708
				(290.177)
Sentrality_index (middle 60th percentile) x altruism_score (bottom tertile)				
bottom 20 percentile x 2nd tertile				-248.733
				(229.356)
bottom 20 percentile x top tertile				-73.316
				(276.895)
Top 20 percentile x 2nd tertile				-155.740
				(203.150)
Top 20 percentile x top tertile				-116.396
				(252.747)
Constant	86.598	-216.794	-568.825***	-639.585***
	(151.294)	(196.355)	(208.605)	(215.154)
pseudolikelihood	-5531.7366	-5522.3349	-5501.7911	-5497.351
Pseudo R2	0.003	0.0051	0.0088	0.001
N	749	749	749	749

Note: *, **, *** indicates significance at 10%, 5%, and 1% levels, respectively. Robust standard errors in parenthesis