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Estimating the Value of Preserving the Doubs

*Nikola Jovanoski**

* *University of Neuchatel*

UNIVERSITÉ DE NEUCHÂTEL

Institut de recherches économiques

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Nikola Jovanoski†

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Abstract

This analysis estimates the value that the inhabitants of the canton of Neuchâtel attach on the preservation of the Doubs. It is achieved with the use of the open-ended contingent valuation method. The results indicate that an inhabitant from this canton is, on average, willing-to-pay 55 CHF per year to preserve the Doubs, which translates to a value of up to 9.63m CHF that the inhabitants of this canton attach on the preservation of the Doubs. These estimates may be used as a guide by the relevant administrative and national authorities in the development of environmental policies.

Keywords: contingent valuation method, open-ended elicitation method

JEL Classification: Q510 Valuation of Environmental Effects

Introduction

The Doubs is a river that is located in the west of Switzerland and in the east of France. It has a length of 453 kilometres and constitutes a part of the border between these two countries. Its source lies in the French part of the Jura Mountains and on or near its course are located a number of cities and towns (Gosse, 1989). It is because of its length and the number of settlements that are located on or near it that the Doubs is important, as it is able to impact on the welfare of the inhabitants that reside in these settlements and surrounding regions.

Alike most other rivers, there are a number of environmental services that are provided by the Doubs which include, but are not limited, to resource services, assimilative services, amenity services and life supporting services (Perman et

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†AFFILIATION: Université de Neuchâtel, e-mail: nikola.jovanoski@unine.ch

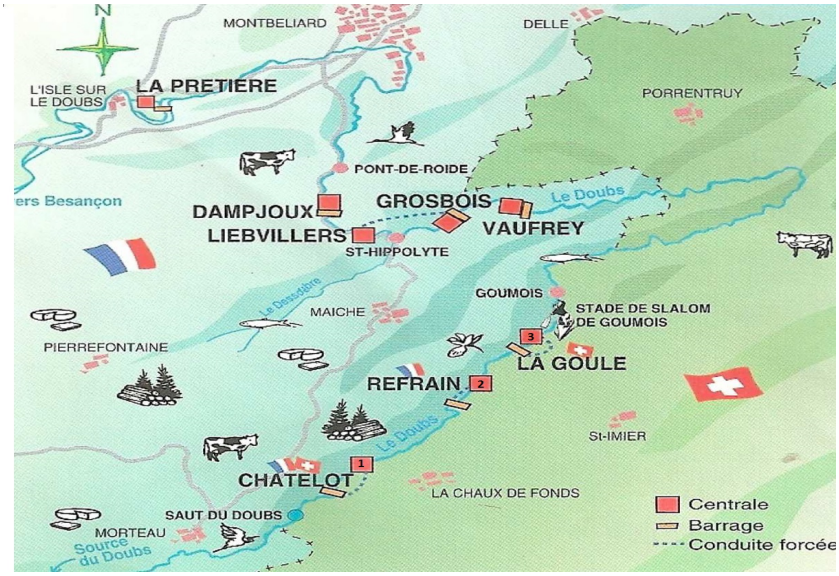
al, 2003). These services may influence the behaviour and benefit of the inhabitants and industries that are situated in these settlements and regions. It may be said that both groups have an interest in the Doubs. As there are a number benefactors and benefits that may be attained from the Doubs, an analysis into the overall value of the river would have been a challenge. It was therefore decided to centre the assessment at hand on examining the benefit that the inhabitants of the canton of Neuchâtel would receive from knowing that the Doubs was being preserved.

The benefit that the inhabitants of the canton of Neuchâtel would acquire from the conservation of the Doubs may be determined by its condition and in turn may provide an insight as to whether it may be preserved. It is fair to state that its condition at this moment in time may be having the effect of reducing the chance of its preservation and thus the welfare of these inhabitants. Although its condition is dismal, it may not be attributed to any one cause as "the causes of the problem remain multiple and unclear" (AAPPMA, 2012). In spite of this, a number of the river's advocates maintain that this deterioration may be attributed to those actions that have contaminated and manipulated its current.

The contamination of the Doubs has been attributed mainly to the flow of waste water into it. Gogniat (2011) states that this behaviour may be observed as late as the 1970's where "waste water from La Chaux-de-Fonds and French cities such as Pontarlier and Morteau was flowing into the Doubs without being treated". Furthermore, the Association for Fishing and Protection of the Aquatic Environment (2012) has stated that the Doubs is also being contaminated by "the watchmaking industry and [by the] intensification of agriculture". Consequently, the contamination of the Doubs has occurred over time and from a number of sources.

The manipulation of the rivers current has been attributed to the operation of the hydro-electric power companies that are situated on it (see figure 1). Their operation involves the "releasing [of] huge quantities of water or [the] draining [of] river banks or gravel bars" (AAPPMA, 2012). This impacts on the depth and current of the Doubs which, as a result, has led to a loss in biodiversity and to the exacerbation of the influence that the contaminated water has on the river. It is a conundrum that the generation of clean energy in this case has led to the impairment of the environment rather than to its improvement.

Figure 1: The Location of the Hydroelectric Power Plants on the Doubs between the Borders of Swizterland and France



Source: AAPMA la franco-suisse (2010). Note: boxes 1, 2 & 3 indicate the hydroelectric power plants.

It is reasonable to state that the incessant mistreatment of the Doubs in this manner could lead to further deterioration of its condition and even to its ecological death. It is nonetheless also reasonable to believe that this need not be the case as it would be in the interest of the inhabitants of the canton of Neuchâtel to prevent such an event from occurring due to the reason that was once set forward by Adam Smith (1982, p. 189) that:

> The qualities most useful to ourselves are, first of all superior reason and understanding, by which we are capable of discerning the remote consequences of all our actions, and of foreseeing the advantage or detriment which is, likely to result from them: and secondly, self-command, by which we are enabled to abstain from present pleasure or to endure present pain, in order to obtain greater pleasure or to avoid a greater pain in some future time.

In relation to this point, it was established through the use of the Contingent Valuation Method (CVM) that indeed it is in the interest of the inhabitants of the canton of Neuchâtel to prevent such an event from occurring and, that they were on average, wiling-to-pay (WTP) an additional 55 CHF on their annual electricity bill in order to preserve the Doubs. This translates to a value of up to 9.63m CHF that the inhabitants of the canton of Neuchâtel attach on the preservation of the river. In relation to these numbers, Mitchell and

Carson (1989, p.17) state that the CVM is primarily used to "obtain an accurate estimate of the benefits of a change in the level of provision of some public good which can then be used in a benefit-cost analysis". It is because of this that the results of this analysis may aide the relevant administrative and national authorities on both sides of the Doubs in the development of environmental policies that are directed towards the river.

The Travel Cost and Contingent Valuation Methods

There has been an increase in the environmental awareness of society in recent years. The environment "is increasingly recognised as [an] asset [that] provides services that are no longer readily available" and, as a result, has promoted the incorporation of these concerns in the decision making process via the use of estimates on the value of an amenity (Smith 1993, p.1). These concerns are incorporated in "the cost-benefit assessment of public goods... the analysis of polices that affect the environment, and... the realistic estimation of environmental damages [that] result from human action" (Kahneman 1990, p.57).

Most environmental economists agree on the importance of these values though disagree on the method of their attainment. The two main methods that may be used are the indirect and direct methods. It is in the words of Smith (1986, p.280) that the former approach, "relies on the behaviour of households in related markets to reveal their valuations of the non-marketed goods" and the latter approach "uses surveys to ask individuals valuations for hypothetical changes in such resources".

The most widely used indirect method is the Travel Cost Method (TCM). This method incorporates information on the cost of travel and on the number of times a site is visited with which to estimate a demand function. The estimated demand function is then used to estimate the value of an environmental amenity. It is because of the supposed use of objective information that its use has been suggested.

The logic that has been used to support the TCM has however been challenged by a number of researchers. It is in the opinion of Randall (1994, p.88) that, "the cost of travel depends, inter alia, on the households opportunity cost of travel time and its activity production technology, both of which are unobservable". This implies that the TCM is not completely based on the notion of observable behaviour and it is because of this that it would be a fallacy to support this method on the grounds of this notion. It is also in the opinion of Bishop (1979, p.926) that "if people were not travelling to the recreation site, most would probably be engaged in other leisure time activities rather than working" and that "travel to some recreation sites, may actually add to the benefits rather than the costs [of travel]". These points query the viability of the use of the cost of travel and in union the use of the method.

The CVM is a "survey based method [which] constructs scenarios that offer different possible future government actions [and where respondents are] asked to state their preferences concerning those actions" (Carson 1999, p.1). These preferences are communicated monetarily and then these amounts are used to estimate the value of an environmental amenity (Brookshire, Randall & Stoll 1980). It is the capability of this method to attach a value on the existence of an amenity that renders the use of it important in the area of environmental valuation. Smith (1993, p.4) also reiterates this point by stating that the TCM is used "to describe the demand for and value of services provided by specific types of recreation sites and not to estimate the value people place on changes in the site's quality features". This implies that the CVM may be helpful in the analysis of a forthcoming public decision as it would be capable of providing an insight into the impact that it would have on the welfare of the society.

There are also a number of economists that oppose the CVM as there are many factors that may influence the answers of a respondent. It is in the opinion of Spash (2008) that an individual could distort their results by providing a strategic answer with which to gain an advantage or, to not answer as if the situation were real. It is also in the opinion of La Piere (1934, p.1) that the "study of attitudes through direct questioning is open to serious objection... because in classifying attitudes the inaccuracy of human judgement is an inevitable variable", and in the opinion of Keynes (1937, p. 214) that "we endeavour to conform with the behaviour of the majority or the average" in uncertain situations. This implies that the only method that may be used to correctly estimate the value of an environmental amenity is that of a method that is based on observable behaviour as the information provided by an individual may not be consistent with their preferences. Moreover, it is in the view of Simon (2000, p. 37) that "people do not have consistent utility functions, even at a single point of time", which re-affirms the opinion of Turing (cited in Copeland 2000, p. 29) that "the mind is a partially random machine". It could be said that this also implies that the results of an analysis that incorporates the CVM may not be concrete. The comments do not end here and a countless number of other factors and explanations have been classified (see Diamond & Hausman 1994; Epstein 2003; Evans 1993; Kahneman 2013; Portney 1994;). Nevertheless, it is in the opinion of Carson and Mithcell (1993, p. 1266) that "if there is a central problem with contingent valuation it is that people will try to answer whatever question is put to them" (Carson & Mitchell, 1993, p. 1266). It is because of this that the construction of a questionnaire should be undertaken with due caution so as to minimise and/or eliminate the effect of the aforementioned issues (Bergstrom, Stoll & Randall 1989).

In completing a review of both methods, it may be deduced that neither one of them is impeccable, though it was the latter method that was applied in this analysis. The TCM may not be used to estimate the non-use value of an amenity. For that reason, the CVM was used to estimate the value that the inhabitants of the canton of Neuchâtel attach on the preservation of the Doubs.

A Review of the Literature

There are a number of studies that have incorporated the CVM to estimate the value of an environmental amenity. In reviewing these studies, one is able to broaden their knowledge on the subject. In this regard, a number of associated CV studies were reviewed.

The effect of distance on the preservation value of water quality is studied by Sutherland and Walsh (1985). They examine the effect that distance has on the value of preserving the quality of water at the Flathead River and Lake in Montana United States of America. It is in their view that "when distance is not explicitly incorporated into an analysis, it is implicitly assumed to have a constant effect across the study region and zero thereafter" (Sutherland and Walsh, 1985, p.281). This implies that the exclusion of distance in a model that would be used to estimate the value of preserving an environmental amenity may bias the end result. For this reason, a regional boundary should be incorporated in these models. It would also be advantageous to set it so that it "reflect[s] the point at which expected preservation values change from positive to zero" (Sutherland and Walsh, 1985, p.283).

The information that was used to undertake the experiment was collected by mailing out a questionnaire to 280 households from four major cities and adjacent rural areas, of which 171 responded. Their results show that "the knowledge gained by visiting [an] area is positively associated with the willingness to pay for the preservation values of water quality [and it is because of this that] those who visit the study area are willing to pay approximately \$8 more than other households for option value, \$30 more for existence value, and \$35 more for bequest value" and that the "willingness to pay for option value decreases at a rate of 1.5¢ per mile compared to decreases of 5.4¢ and 6.3¢ per mile for existence and bequest values" (Sutherland and Walsh, 1985, p.288). These results reaffirm the original ideas of the authors and it is because of this, that distance should be included in a CV analysis, as well as other information based influences.

In contra to the recommendation that is offered by the authors, the regional boundary of this analysis was not defined in a manner that sets the border at a point where the value that one attaches to the preservation of the Doubs converses from positive to zero. In spite of this, distance was included in the analysis so as to examine whether it had the ability to significantly influence the WTP of an individual.

McConnell (1977) examines the effect that congestion has on the use on a set of Rhode Island Beaches in the United States. It is in the opinion of the author that "the quality of the site diminishes as the use of the facility increases [though] these same endogenously determined site quality variables become important determinants of the demand for a recreation facility" (McConnell 1977, p.186). This implies that an increase in the use of an amenity to a point where it becomes congested could have the effect of decreasing the value of the environmental

amenity.

The information that was used to undertake the analysis was obtained by conveniently interviewing 229 individuals from six Rhode Island Beaches. The results show that "an extra 100 people per acre on the average beach reduces the average individual's surplus per day by about 25 percent" (McConnell 1977, p. 191). This result reaffirmed the idea of the author that the congestion of an environmental amenity could diminish its value.

The results of this analysis are important as they imply that the benefit that one may derive by knowing that they may use an environmental amenity in the future may differ to the benefits that they may derive from actually using it. This implication is in accordance with what was stated by Keynes (1937, p.214) that "individuals largely ignore the prospects of future changes". If this is correct, an individual may naïvely over or under report on the benefit that they would receive from knowing that they may use an environmental amenity in the future, in comparison to the value that they would obtain from actually using it. This may have a serious implication on the development of environmental policies and it is because of this that it should be analysed in upcoming CV studies to examine whether the idea is supported in reality.

Carson and Mitchell (1993) estimate the value of clean water at the national level by incorporating the use of the CVM in a manner that avoids the geographical aggregation problem of evaluating a set of environmental amenities. Instead of inquiring on the value of clean water at a number of amenities and then summing the obtained values, the authors inquired on the "value [of] a national set of water quality improvements" in the United States (Carson & Mitchell 1993, p.2445). The sample that was used to complete this analysis consisted of 813 individuals and they were chosen with the aid of a national area probability sampling plan. It is not the results of this analysis that are of interest but the manner in which it was executed. A similar approach could be used to evaluate a set of environmental amenities that are located in the canton of Neuchâtel or in Switzerland so as to avoid the problem of geographical aggregation.

Walsh, Loomis and Gillman (1984) estimate the value of preserving the wilderness area of Colorado in the United States. In doing so, they complete a benefit-cost analysis on the issue of designating additional land to it and analyse whether its estimated value changes with the inclusion of an estimate on its value of preservation. In order to participate in the analysis, the 218 respondents that partook in the analysis were required "to make a series of four budget allocation decisions based on total annual benefits received from increments in wilderness designation" and then to allocate the highest budget designated to the four categories of value that were being examined (Walsh et al. 1984, p.17). With the use of this information, the area's value was measured by estimating its recreational value and the value of preserving it with the use of the TCM and CVM.

It was concluded that an increase in 8.8 million acres of wilderness area increased the WTP of preserving it by $18 per household and by approximately

$20m to the inhabitants of Colorado (Walsh et al, 1984). This implies that the value that one attaches on the preservation of an environmental amenity may be affected by its size. It was also concluded that adding the "preservation value to the consumer surplus of recreation use, had a substantial effect on the benefit function for wilderness", in that it increased the annual value of the wilderness area from $23m to $58m (Walsh et al. 1984, p.26). These results suggest that the non-use values of an amenity are as essential as the use values of an environmental amenity.

The Australian Resource Assessment Commission (1994) estimated the value of preserving the Kakadu Conservation Zone (KCZ) by connecting it to the Kakadu National Park (KNP) in Australia. It was an important study as it determined whether the mineral deposits that were situated at the site could be extracted and thus determined the benefit that Australians derived from it.

The information that was used to complete the study was obtained by interviewing a sample of the inhabitants that lived in Australia and the Northern Territory. The use of the latter sample was to correctly represent these inhabitants as the KCZ was located in the Northern Territory. From the former sample, 2034 individuals were interviewed and from the latter sample, 502 individuals were interviewed. The individuals from each sample were moreover separated in to two cohorts with the idea of examining whether a difference in the severity of the theoretical scenario altered the WTP of a respondent. The results confirmed that the mean and median WTP of the inhabitants of the Northern Territory were lower than the inhabitants of Australia and that the mean and median of the WTP were influenced by the severity of the scenario. In order to conservatively measure the value that the inhabitants of Australia attached on the preservation of the KCZ, the median WTP of the sample that received the less severe scenario was employed. It was determined that the KCZ had a preservation value of $AUD 435m and it was because of this that that the Australian Government decided to preserve and connect it to the KNP (for a further analysis of the results see Carson et al 1994).

The results of this analysis suggest that the economic value of an environmental amenity could depend on the population used to estimate it. In this case, the inhabitants of the Northern Territory attached a lower value on the preservation of the KCZ in comparison to the inhabitants of Australia. These results may still be consistent with the findings of Sutherland and Walsh (1985) though in this case more information on the KCZ resulted in the inhabitants of the Northern Territory reporting a lower WTP. It would be of interest to compare the results of an analysis that estimated the value that the inhabitants of Switzerland attach on the preservation of the Doubs with the results of this analysis, to examine whether the anomaly would subsist.

Alberini, Rosato, Longo and Zanatta (2004) estimate the value of S. Erasmo in the lagoon of Venice in Italy. The information that was used to undertake the study was obtained by interviewing 1330 households from the Veneto region by telephone, though excluding the residents of the island. These households were

sent a letter prior to the survey to inform them on the upcoming interview and were provided with the theoretical circumstance that would be used to improve the environmental quality of the island. It was estimated that the mean and median WTP were €20 and €67 which translated to a value of €41m and €107m to improve the environmental quality of the site. The method that was used by the authors to inform the sample on the upcoming interview is of interest as a similar method was used to inform the inhabitants of the canton of Neuchâtel concerning the online questionnaire. It is believed that the number of replies to the online questionnaire may have been influenced by the issue of the letter not being sponsored by a government body, and it is because of this that more research on this topic would be beneficial as it could inform researchers on the influence that it may have on their studies.

Questionnaire

The Design of the Questionnaire

The questionnaire consisted of two sections. In the first section, an overview on the condition of the Doubs was presented along with the theoretical solution that would allow for the improvement of it, and in the second section, the questions were presented (see appendix for questionnaire). The second section was structured so as to inquire on the attitudes-beliefs and behaviour of the respondent at the onset of the questionnaire, and to inquire on their intentions and socio-economic circumstance at the completion of it. This structure was adopted with the aim of reducing the drop-out rate of the questionnaire by inquiring on confidential issues towards the end of it (Fishebein & Ajzen, 1975).

The first section of the questionnaire was instigated with an overview on the condition of the Doubs. It was noted that the condition of the Doubs may influence the welfare of the respondent and a list was provided on the causes of its deterioration. This information was provided with the aim of informing the respondent on the situation. It was also mentioned that these causes could be promoting the ecological death of the Doubs. This information would form the basis of the theoretical resolution.

The theoretical solution, which included the regulation of the hydro-electric power companies that operate on the Doubs, supported by an increase in the annual electricity bill of the Swiss and French inhabitants that reside in the regions that surround it, was presented at the end of the first section. It was mentioned that there was not a single solution that would be able to improve the condition of the Doubs and that a comprehensive solution would need to take into consideration the already mentioned causes. This was mentioned to reduce the possibility of a respondent disputing the questionnaire on the basis of maintaining a different perception on the appropriate solution, and to indicate to the respondent that the theoretical solution was not complete and that it was merely used to simplify their task in completing the questionnaire. The

respondents were also informed that the effectiveness of the solution would depend on their answers. This was to ensure that the respondent perceived their input as important, and to consequently increase the incentive capability of the questionnaire (Mitchell & Carson, 1989).

The second section was initiated with a list of questions that inquired into the attitudes and beliefs of the respondent. It is in the opinion of Mitchell & Carson (1989, p.180) that "a belief is a probability judgement that links some object or concept to some attribute" and that "an attitude is the bipolar evaluative judgement of an object". This implies that the attitude and belief of a respondent may influence their behaviour and intent. Such information is important as it may be used by future studies on the Doubs. The first set of questions inquired into the reasons that propelled the respondent in to agreeing or disagreeing in contributing to the preservation of the Doubs and the reasons that influenced the quantity of the contribution. This information was used to check the consistency of the answers that were provided. The second set of questions inquired into the belief of the respondent on how else they thought the river may be remedied and on how else they thought they would benefit from the remedying of the river. This information was collected to defend the use of the theoretical solution and to defend the aspects that were being analysed.

This section was advanced with questions that inquired into the behaviour and intent of the respondent. Information on the behaviour of the respondent was important as it would allow us to determine whether there was a connection between the behaviour of the respondent, their intent in contributing to the preservation of the Doubs and in their use of it in the future for recreational purposes. It was obtained by questioning the respondents on their annual visitation to the Doubs and on whether they visited substitute sites for recreational purposes. Information on the intent of the respondent was signalled through their WTP to have the operation of the hydro-electric power companies regulated, through an increase in their annual electricity bill. The respondents that were not WTP were encouraged to provide an explanation on why they were not WTP. This was undertaken so as to reduce the effect that the respondents that were objectionably not WTP had on the end results (Hanemann 1994). An open-ended question was used to inquire into the WTP of the respondents. Therefore, the results of the study could be used to construct the bids of a dichotomous choice CV study on the Doubs so as to minimise the effect of anchoring on the supposed study (Tversky & Kahneman 1974; Boyle & Bishop 1988). As a result of this, a lower estimate on the value of preserving the Doubs was expected, than if a close-ended question and the willingness-to-accept (WTA) indicator was used (Barrio and Loureiro 2010; Brown et al 1996; Ready, Buzby & Hu 1996; Tversky and Kahneman 1986). This section was concluded with questions that inquired into the socio-economic characteristics of the respondents.

The Pre-Testing of the Questionnaire

The questionnaire was pre-tested in two phases before it was deemed eligible to be used. In the first phase, the questionnaire was reassessed by two researchers at the University of Neuchâtel, between the 15th of January and 13th of April. In the second phase, a cohort of students at the University of Neuchâtel completed the questionnaire and commented on it between the 7th and 13th of April. This was to increase the clarity, interpretability and credibility of the questionnaire.

The clarity of the questionnaire was enhanced by presenting a clearer image on the condition of the Doubs, in seperating the information that was provided in section 1 of the questionnaire in accordance to its type. It was also achieved by wording the section in a manner so as to directly connect it to the respondent. The interpretability of the questionnaire was improved by presenting less ambiguous questions, through the replacement of non-common terms by common terms. It was also achieved by including more answers to certain questions. The credibility of the questionnaire was enhanced by presenting a more realistic image on the condition of the Doubs, by including more information on the issues that were undermining the condition of the Doubs and with the removal of information that may have influenced the behaviour of the respondents. It is thought that these changes improved the clarity, interpretability and credibility of the questionnaire.

Methodology

Estimates on the mean and median WTP were obtained with the use of the Kaplan-Meier Product Line Estimator, and the theoretical and intuitive validity of the answers were assessed with the use of the results of a TOBIT model (Bateman et al. 2002, Li and Racine 2007).

The Kaplan-Meier Product Line Estimator

The Kaplan-Meier Product Line Estimator is similar in comparison to the Turnbull Distribution-Free Estimator that may be used to analyse the answers of CV studies that incorporate the use of the dichotomous choice elicitation method (Kristrom 1990, Haab & McConnell 2002). Its employment involved "arranging the sample's WTP values in ascending order and tracing out the survivor function by calculating the proportion of the sample that [had] a WTP greater than each value" (Bateman et al. 2002, p. 226).

The first step of this process involved representing each distinct WTP by a C_j where C_0 is equal to zero and where C_J is equal to the largest WTP. Superscript j is running from 0 to the maximum willingness to pay observed in the sample. The second step involved calculating, at each C_j, the number of respondents that had a WTP that was greater than C_j, which is denoted by n_j. With the use of these estimates, the third step involves estimating the survival function at each C_j or the share of the sample that had a WTP greater than C_j:

$$S(C_j) = \frac{n_j}{N}$$

where, N is the total number of individuals that are in the sample. The last step involved the use of the estimates that were obtained in the third step to estimate the mean WTP:

$$\bar{C} = \sum_{j=0}^{J} S(C_j)[C_{j+1} - C_j]$$

The obtainment of the median WTP did not involve any calculation and it was equal to the WTP at the point where the distribution passed 0.5.

The TOBIT Model

The TOBIT model was used to determine whether the answers that were reported by the respondents were in accordance with their theoretical and intuitive expectations by exploring the direction of the effect that the independent variables of the model had on the WTP of an individual in the sample. This model was used due to the fact that "negative responses to the contingent valuation question are not realised" (Lipton 2003, p.9). The use of OLS in this case "would yield biased and inconsistent estimates because it fails to account for the qualitative difference between limit (zero) observations and non-limit (continuous) observations" (Haddak, Havet & Lefevre 2014, p.9). The TOBIT model is presented as:

$$W\acute{T}P_i = \alpha_0 + \alpha_1 X_i + \epsilon_i$$

where, $W\acute{T}P_i$ is a latent variable and is the WTP of individual i, X_i is a vector of independent variables that includes information on the behaviour and socio-economic characteristics of individual i, ϵi is an error term and the $\alpha' s$ are the parameters of the model that were estimated. The relation between the observed and latent WTP's is:

$$\begin{array}{llll} WTP_i = W\acute{T}P_i & if & W\acute{T}P_i \geq 0 \\ WTP_i = 0 & if & W\acute{T}P_i < 0 \end{array}$$

The Method for Aggregating

The estimated mean and median WTP were used to calculate the value that the inhabitants of the canton of Neuchâtel attach on the preservation of the Doubs with the use of the Administrative Area Based Aggregation Method. This involved multiplying these measures by the number of inhabitants that reside in the canton of Neuchâtel. This method was preferred to a method that incorporated the influence of distance in measuring this value as it was determined that distance did not significantly influence the WTP of the respondents (Bateman et al, 2002).

Descriptive Statistics

It is because the analysis is centred on the cantonal population of Neuchâtel that the results do not offer a comprehensive estimate on the value of preserving the Doubs. In order to attain a more comprehensive estimate on this value, the use of a more extensive regional boundary would be required by including individuals that reside in the other cantons of Switzerland and in France.

A list of addresses from a database on officially registered addresses in Switzerland and a list of student emails from the Faculty of Economic Science at the University of Neuchâtel were used to construct a sample on the cantonal population of Neuchâtel. From the former sample frame, 800 individuals were chosen with the use of the proportionate stratified sampling approach to correctly represent each district and commune of the canton, and all the students were chosen from the latter sample frame. The former sample frame was used to ensure that a representative sub-sample of the cantonal population of Neuchâtel was constructed, and the use of the latter sample frame was to conveniently increase the size of the sample.

Individuals from both sub-samples were directed to complete an online questionnaire between the 25th of May and 14th of July 2014. The former sub-sample was notified about the questionnaire through letters and the latter sub-sample was notified about it through e-mails. Although the NOAA Panel (1993) has recommended the use of in-person interviews, the use of an online questionnaire was chosen due to the constraints imposed on certain features of the research, and it is because of this that it is believed that the use of this mode may have depressed the end response rate.

A total of 162 respondents executed the online questionnaire. From these respondents, 65 of them were from the random sub-sample, which translates to a response rate of 8 percent, and 97 of them were from the student sub-sample. It may be stated that this response rate is low taking into account that Gogniat (2011), Loomis et al (2000), and Sutherland & Walsh (1985) obtained response rates of 30, 25 and 61 percent. It may also be stated that these response rates may not be compared to one another taking into account the dissimilarity of the studies. In relation to the study of Gogniat (2011), the difference in the response rates may be attributed to the fact that this study was centred on the individuals that fished in the Doubs. If this cohort of individuals are on average more concerned about the condition of the Doubs than the inhabitants of the canton of Neuchâtel, they would have had more of an incentive to complete the questionnaire. In relation to the study of Loomis et al (2000), the difference in response rates may be attributed to two reasons. The first reason is due to the fact that this study obtained their information by interviewing their sample. It is in accordance with the theory on this aspect that the response rate of a study that incorporates the use of an interview or telephone questionnaire should be greater than the response rate of a study that incorporates the use of a mail questionnaire. The second reason is due to the fact that the sample was contacted after they had received the letter. This may have induced some

individuals that were initially not prepared to participate in the interview to participate. In relation to the study of Sutherland & Walsh (1985), the difference in response rates may be attributed to the fact that the questionnaire was sent out twice to their sample. Alike, the second point that was mentioned in relation to the study of Loomis et al (2000), this may have persuaded the respondents that were not ready to partake in the questionnaire to complete the questionnaire. It is evident that a number of reasons may have influenced the response rate of this analysis and it is because of this that it would be incorrect to explain the low response rate with only one reason. What may be deduced, however, is that the low response rate may have increased the effect of sample selection bias though "without analogous data on [the] people who opted out of the survey [it was not possible to] control for... [it] ...in a rigorous way" (Moore, Holmes & Bell, 2011, p.42). It is because of this that the preferences of the inhabitants that are more concerned about the Doubs may have influenced the end results.

Information from 9 respondents from the random sub-sample was omitted as they did not entirely complete the questionnaire. From the student sub-sample, information from 67 students was omitted as 42 of them did not entirely complete the questionnaire and a further 25 of them did not reside in the canton of Neuchâtel. In total, 56 out of the 86 respondents that were used in the analysis were from the former sample and 30 were from the student sub-sample. It is of interest to note that the problem of item non-response was relatively mitigated by the use of a force response option that required the respondents to answer the previous question before proceeding to the subsequent question. This option was employed with the aim of increasing the number of entirely completed questionnaires, although it may have simultaneously discouraged a number of the respondents from continuing to completion, as only 111 out of the 162 questionnaires that were started were completed entirely. The inclusion of this constraint may have led to an increase in the bias of the results by possibly discouraging the already non-interested individuals from completing the entirety of the questionnaire. The use of this constraint in online CV questionnaires should be used with due caution as there is an evident trade-off between that of eliminating the effect of item non-response bias and increasing the effect of sample selection bias.

Table 1 presents the descriptive statistics on the socio-economic characteristics of the respondents. This information was included in the econometric model to determine whether the information that was provided by the respondents was in accordance with its theoretical and intuitive expectations. It will now be determined whether the sample was representative of the cantonal population of Neuchâtel.

Table 1. Descriptive Statistics on Socio-Economic Characteristics of Respondents

				Cantonal Statistics				
Variable	Obs.	Mean	Median	Mean	Median	S.D.	Min	Max
Age	86	45.03	45	41.43	40-64	19.11	19	79
Gedner	86	0.39	0	0.51	1	0.49	0	1
Education	86	0.80	0	0.28	0	0.40	0	1
Distance	86	26.68	31	-	-	11.20	3	46
Live*	86	4.34	5	-	-	1.28	1	5
Adult	86	2.04	2	-	-	1.06	0	5
Child	86	0.47	0	-	-	0.87	0	4
Income (CHF)*	86	3.30	3	-	5785	2.22	1	7
Member/Donate	86	0.24	0	-	-	0.43	0	1

Note: Cantonal statistics obtained from the Swiss Federal Statistical Office (FSO) and the Service du statistique of the canton of Neuchâtel. * indicates that the information is categorical. Live cat -egories (in years) are, 1= 0-2, 2= 2-5, 3= 5-10, 4= 10-20 & 5= 20+.Income categories (in CHF) are, 1= 0-3000, 2= 3001-4000, 3= 4001-5000, 4= 5001-6000, 5= 6001-7000, 6= 7001-8000 & 7= 8001+. Also, this is monthly income, and not annual income.

The variable *age* shows that the average age of the respondents was 43 and that the median respondent had an age of 45. The former statistic is not in accordance with the mean age of the canton though the latter statistic is in accordance with the median age of the canton. The variable *gender* indicates that 61 percent of the respondents were male and that 39 percent of the respondents were female. These statistics are not in accordance with the statistics on the distribution of gender of the canton, where approximately 51 and 49 percent of the inhabitants are female and male. This departure could be due to a number of reasons, though the most obvious seems to be that it may have emerged as a result of the influence of sample frame bias. The variable *education* displays that 80 percent of the respondents have attained a tertiary level of education. This is not in accordance with the cantonal statistic on this measure which shows that only 28 percent of the cantonal population has attained a tertiary level of education. It should be noted that this statistic was to a certain extent influenced by the student sub-sample though the attainment of tertiary level education of the random sub-sample is also rather high at 65 percent. The variable *distance* shows that the respondents resided at a distance of 26 km, on average, from the Doubs. This is in accordance with the fact that a majority of the cantonal inhabitants reside in the districts that do not border the Doubs. As direct information on the distance from a respondent's place of residence to the Doubs was not obtained, the use of their postcode was used to measure the road distance from the centre of their locality to the locality of Les Brenets or Le Valanvron. The nearest destination was chosen to undertake the measurement and was accomplished with the use of google maps. The variable *live* displays that the respondents have on average, lived in the canton between 10-20 years.

This statistic may have been depressed by the inclusion of students in the sample that originate from outside Neuchâtel, as the median respondent has lived in the canton for more than 20 years. The variable *adult* shows that there were on average 2 adults that resided in the household of an individual from this sample. The variable *child* indicates that a large number of the respondents did not have children living in their household. This is due to the fact that only 24 of the respondents reported that that there were children that resided in their household. If the average of this variable is computed for this sub-set of respondents, there are on average 2 children that reside in the household of these respondents. The variable *income* shows that the average and median monthly income of the sample is between $4000 - 5000$ CHF. This interval does not include the median monthly income of the canton of 5785 CHF though is included in the interval on the average monthly income of the random sub-sample of $5000 - 6000$ CHF. The variable *memberdonate* indicates that only 24 percent of the respondents are members and/or donate to environmental organisations. This may be due to the fact that a majority of the respondents may believe that the environmental policy of Neuchâtel and/or Switzerland is at present effective enough to deal with the environmental problems of the canton. To reiterate what was mentioned, the sub-sample of students were included in the sample to conveniently increase its size, though may have as a result impeded on its statistical representativeness. It is because of this and because of the the low response rate that it is believed that the effect of sample selection bias may have influenced the end results.

Table 2 presents the descriptive statistics on the importance that the respondents attach on knowing that they may use the Doubs in the future, that future generations may use it in the future, and that it exists. This importance was captured with the use of a 5 point LIKERT scale (see table A1 in appendix for variable definitions). The respondents were placed into three groups to more clearly analyse this information and consist of (1) respondents that are concerned about the ecological quality of the river but that do not use it for recreational purposes, (2) respondents that are not concerned about the ecological quality of the river and that do not use it for recreational purposes, and (3) respondents that are concerned about the ecological quality of the river and that use it for recreational purposes. This information was not used in the econometric model. It was instead used to analyse whether there was a difference in the WTP of these groups.

Table 2. Descriptive Statistics on the Attitudes of the Respondents

Group	Variable	Obs.	Mean	Median	S.D.	Min	Max
(1)	Bequest	35	4.02	4	.74	2	5
	Existence	35	4.22	4	.49	3	5
(2)	Bequest	20	3.6	4	.75	1	4
	Existence	20	3.65	4	.98	1	5
(3)	Bequest	31	4.32	4	.70	2	5
	Existence	31	4.58	5	.50	4	5
	Future Use	31	4.25	4	.77	2	5

Note: refer to in text description for group definitions. Bequest= know that future generations may use the Doubs, Existence= know that the Doubs exists in pristine condition, & Future Use = know that they may use the Doubs in the future. Importance: 1= not important at all, 2= no -t important, 3= neutral, 4= important & 5= very important.

The respondents from the first group on average believe that it is important for them to know that future generations may use the Doubs and that it exists, where the respondents from the second group on average are neutral on the fact of knowing whether the Doubs may be used by future generations and on its existence. The median respondents from both these groups believe that it is important for them to know that future generations may use the Doubs and that it exists, thus suggesting that the average attitude from the second group may have been depressed by respondents that placed no importance on these aspects of the river. The respondents from the third group on average believe that it is important for them to know that they may use the Doubs in the future, that future generations may use it, and that it exists. Unlike the median respondent from the previous two groups, the median respondent from this group believes that it is very important for them to know that the Doubs exists. It may be stated that the importance a respondent attaches on one of the above aspects is positively influenced by whether they are concerned with the ecological quality of the river and by whether they use it for recreational purposes. A reason on the effect of the former influence may not be needed to understand it, though an explanation on the effect of the latter influence may be needed. The use of the Doubs for recreational purposes may impart an individual with additional information on these characteristics, which in this case, has led to the attachment of a higher importance on them by these individuals. In summary, it was deduced that the effect of both influences were significant on the importance a respondent attached on knowing that the Doubs would be bequeathed to future generations and on knowing that it does and will exist in pristine condition (see tables A4-A9 in appendix).

Table 3 presents information on how the respondents believe that the condition of the Doubs may be improved. This information was not used in the econometric model but was instead used to defend the theoretical solution. This information may be also used to assist future studies on the Doubs in the development of their theoretical solution as it will show which of them are most commonly accepted.

Table 3. Information on the Beliefs of the Respondents

Solution	No. of Respondents	Pr. of Respondents
Regulate Operation of Hydro Power Companies	50	58
Construct Waste Water Reclycing Centres	54	62
Construct More Water Treatment Plants	45	52
Fine Households and Firms that Pollute the River	63	73
Invest in Alternative Sources of Energy	41	47
Regulate Agriculture and Forestry near the River	66	76

Only 58 percent of the respondents agreed that regulating the operation of the hydro-electric power companies could be used as a policy to improve the condition of the Doubs. Of the theoretical solutions, only 2 were accepted by 70 percent or more of the respondents. These include the penalisation of households/firms that pollute the river and the regulation in the behaviour of agriculture and forestry near the river. Alternatively, only 1 of the theoretical solutions was not accepted by a majority of the respondents, this being the investment in alternative sources of energy. It is evident that the main view of the respondents is that the condition of the Doubs should be improved by dealing with the sources that are contaminating it. If this opinion is consistent with the of the inhabitants of the canton, the choice of the theoretical solution in this analysis may have reduced the number of inhabitants that were ready to complete the questionnaire.

Table 4 presents information on how the respondents believe they would benefit from an improvement in the condition of the Doubs. This information was not used in the econometric model but was instead used to defend the aspects of the Doubs that were analysed. This information may also assist future studies on their choice of what to examine.

Table 4. Information on the Beliefs of the Respondents

Benefit	No. of Respondents	Pr. of Respondents
Bequest	49	56
Existence	73	84
Future Use	31	36
Improvement of Health	34	39
Improvement in Living Conditions	38	44
Increase in Housing and Land Prices	16	20
Increase in Income	13	16
Increase in Tourism	39	45

From the respondents, 56 percent of them agreed that the improvement in the condition of the Doubs would benefit them by knowing that future generations could use it, 84 percent of them agreed that it would benefit them by knowing

that it exists, and 36 percent of them agreed that it would benefit them by knowing that they may use it in the future. These results reinforce the basis of the analysis, as 2 out of the 3 aspects the analysis is centred on are the most important sources of benefit, which the preservation of the Doubs would ensure. Apart from these aspects, an increase in tourism, an improvement in health and an improvement in living conditions also seem to be important but not as important as the aspects that were aforementioned.

Table 5 presents the descriptive statistics on the number of times the respondents visit the Doubs per year and on whether they visit other lakes and rivers for recreational purposes. The variable visits was used in the econometric model to analyse the direction of the effect that the behaviour of a respondent had on their WTP, and the percentage of the respondents that reported that they visit substitute sites for recreational purposes was compared to the percentage of respondents that reported that they visit the Doubs for the same purposes.

Table 5. Descriptive Statistics on the Behaviour of the Respondents

Variable	Obs.	Mean	Median	S.D.	Min	Max
Visits	86	11.62	2.5	30.01	0	218
	81	5.20	2	7.60	0	34
Substitute	86	.90	1	.29	0	1

Note: Substitute shows whether the respondent visits other rivers and lakes for recreational purposes with 1= YES and 0= NO. There are two rows on the statistics of the variable visit. First row contains the statistics on all respondents & second row contains the statistics on the respondents that visit the Doubs less than 50 times per year.

The respondents on average visit the Doubs 11 times per year. This number has been inflated by 5 of the respondents that reported that they visit the Doubs more than 50 times per year. With the exclusion of these answers, the average is reduced to 5 times per year. In order to be able to comment on whether this statistic is high or low it may need to be compared to the number of visits that the respondents complete to substitute sites. Such information was not obtained, however, information was obtained on wether they did visit substitute sites for recreational purposes. From the respondents, 90 percent of them reported that they visit substitute sites for recreational purposes. This statistic is low in comparison to the 36 percent of the respondents that use the Doubs for the same reason. In general, it may be deduced that this difference is large and an explanation on its cause may not be provided. Information as to why the respondents did not use the Doubs for recreational purposes was not collected.

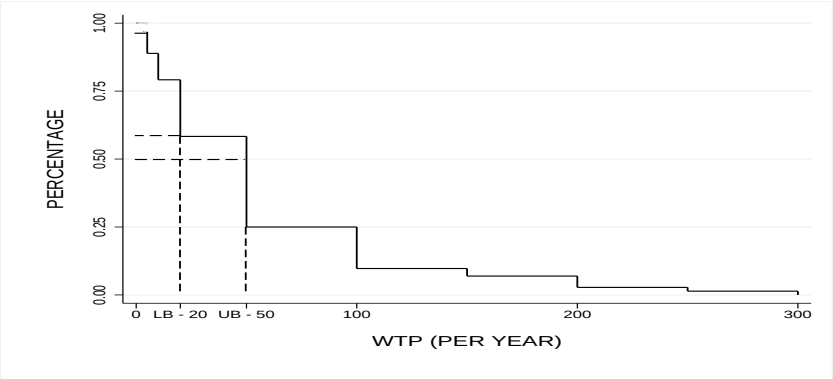
Results

The Analysis of the WTP

The respondents that were not WTP were analysed in advance of estimating the median and mean WTP. From the 86 respondents, 14 answered that they would not be WTP anything on top of their current annual electricity bill to have the water flow management of the hydro-electric power companies regulated. These respondents were encouraged to provide a reason as to why they were not WTP as this information would be used to separate those respondents that were genuinely not WTP from those that were objectionably not WTP. From the 14 respondents, 3 answered that they were not WTP as they were not concerned about the condition of the Doubs, that they would rather use their money for other purposes, and/or that they did not have the financial capability, and 11 answered that they were doubtful about the success of the solution and/or that it was not their responsibility. It is the latter respondents that are of interest as they implicitly tell us that they may attach a value on the preservation of the Doubs but do not believe that they should be held accountable for the misconduct of others and in the success of the solution. Their inclusion may therefore bias the results and it is because of this that the median and mean WTP were estimated, both with and without the use of these respondents. This was also to compare their differences and as sample selection bias may have influenced the results with their exclusion (Halstead, Luloff and Stevens 1992; Mekonnen 2000). These estimates were also measured with the answers that were provided by the respondents from the random sub-sample to be able to compare them with the estimates that were measured with the use of the above respondents.

Figure 2 is a survivor function and presented at each point is the probability of observing a WTP that is larger than a particular WTP. Information on the respondents of the complete sample, without the use of those that were objectionably not WTP, was used to construct it. The probability of observing a WTP that is larger than a particular WTP is on the vertical axis and the level of the WTP is on the horizontal axis. An upper and lower bound on the median WTP are also presented. The use of an alternative method to construct the curve of the function would have resulted in a median between these bounds (see table A2 in appendix for estimates).

Figure 2. Kaplan-Meier Survivor Estimate



From the figure, it is evident that the minimum anyone would be WTP to preserve the Doubs is 0 CHF and that the maximum is 300 CHF. It is therefore assumed that it is improbable for an inhabitant from the canton of Neuchâtel to be WTP more than this amount. This may not be correct though the use of 300 CHF as an upper bound in this case was due to the fact that it was the largest amount reported in the questionnaire. It may be deduced that less than 25 percent of the respondents were WTP less than the lower bound of the median of 20 CHF and less than 25 percent of the respondents were WTP more than the upper bound of the median of 50 CHF. This indicates that the questionnaire was incentive compatible in the sense that it eliminated or reduced the effect of strategic bias as evidence of this bias would have shown WTP's clustered towards the extremes.

Table 6 presents the mean WTP for the groups of respondents that were used in table 2. The mean WTPs in column (a) were estimated with the respondents from the complete sample, excluding the respondents that were objectionably not WTP, and those in column (b) were estimated with the respondents from the random sub-sample and also excluding the respondents that were objectionably not WTP. It is not a surprise that the mean WTP of those respondents that are concerned about the condition of the Doubs is larger than the WTP of those respondents that are not concerned about the condition of the Doubs, and that the WTP of those respondents that use the Doubs for recreational purposes is larger than the WTP of those respondents that do not use it for recreational purposes. Simultaneously, the more importance a respondent attaches on the conservation of the Doubs the more they are WTP to have the Doubs conserved which supports the consistency of the information that was obtained. It was inferred through the use of a two sample t-test that the differences in the WTP were significantly influenced by the above effects (see table A10-A13 in appendix for results).

Table 6. Comparison of Mean WTP

Group	Mean WTP	
	(a)	(b)
(1)	42.50	42.22
(2)	39.44	42.50
(3)	80.55	82.20
Obs.	75	47

The bounds of the median and the mean WTP are 20-50 CHF and 55 CHF. It should be noted that the inclusion of the respondents that were objectionably not WTP altered the bound of the median and the mean WTP to 10-20 CHF and 47 CHF. The bounds of the median and the mean WTP are 20-50 CHF and 62 CHF if only the random sub-sample is used. It is no surprise that the inclusion of respondents that were objectionably not WTP in this case also altered the median and mean WTP to 20 CHF and 52 CHF (see tables A2 & A3 in appendix for figures used to construct mean).

To estimate the value that the inhabitants of the canton of Neuchâtel attach on the preservation of the Doubs, the use of a figure on the number of inhabitants that reside in the canton was obtained from the Federal Statistical Office of Switzerland (FSO). The FSO reported that there were approximately 175 000 inhabitants residing in the canton of Neuchâtel in the year 2012. With the use of the lower and upper bound of the median, the inhabitants of the canton of Neuchâtel attach a value of up to 3.5m-8.75m CHF on the preservation of the Doubs and with the use of the mean, it increases to 9.63m CHF (see table A14 in appendix for additional results). This value is substantial taking into account that the analysis is centred on only one set of benefactors and on one aspect of the Doubs. It is also only a share of the value that Gogniat (2011) estimated on the value of its restoration of 48m CHF. This departure could be due to a number of reasons though the most prominent reason seems to be that the study of Gogniat (2011) was centred on the cohort of individuals that fish at the Doubs, a cohort of individuals that may attach a larger value on the Doubs in comparison to the inhabitants to the canton of Neuchâtel. Nevertheless, the value of 9.63m CHF should be treated as a lower bound on the value that the inhabitants of Neuchâtel attach on the preservation of the Dobs taking into account that "society has a much longer life expectancy than individuals [and it is because of this that] the value that society attaches to natural resources and the environment is likely to deviate from the aggregate of individual values" (Munda 1996, p. 165).

The Inspection of the Questionnaire and Information

The questionnaire and the estimates on the mean and median of the WTP were inspected to assess the quality of the questionnaire and whether the information that was provided was in accordance with theoretical and intuitive expectations (Bateman et al, 2000). The former assessment was accomplished by determining

whether the questionnaire was clear, interpretable and credible, and the latter assessment was accomplished by inspecting the results of the TOBIT model.

The quality of the questionnaire was assessed with the feedback that was provided by all of the respondents from the final questionnaire and with a visual inquest into the answers that were provided. From the 111 respondents, 20 of them provided their feedback, with 3 of them criticising the analysis and with 17 of them supporting it. From the 3 respondents, 2 criticised the analysis on the grounds that there was no value that could be attached to saving an environmental amenity and that it should not be ordinary individuals that cover the cost of conserving the Doubs, and 1 criticised the use of the payment vehicle in that an increase in the cost of electricity would be covered by households and not individuals. Although these criticisms are directed at the analysis, they are not directed at the clarity, interpretability or credibility of the questionnaire and this is why they were not used to assess the quality of the questionnaire. In regards to the other comments, it seems that the respondents were pleased with the analysis. The visual inquest consisted of examining the answers that were provided by the respondents on different questions and determining whether they were consistent. The descriptive statistics from table 2 show that the concern of a respondent towards the Doubs and their recreational use of it may influence the importance they attach on the conservation of the Doubs. This information would be consistent with the information on the WTP of a respondent if these effects influence their WTP in the same manner. The results of table 6 show that they are in accordance with this expectation and it is because of this that it may be said that the attitudes of the respondents are in accordance with their intent of conserving the Doubs. It may be stated that the comments and the results of the visual inquest support the clarity, intepretability and credibility of the questionnaire.

The following TOBIT model is estimated:

$$WTP_i = \alpha_0 + \alpha_1 visits_i + \alpha_2 distance_i + \alpha_3 age_i + \alpha_4 gender_i + \alpha_5 education_i + \alpha_6 income_i + \alpha_7 live_i + \alpha_8 memberdonate_i + \alpha_9 adult_i + \alpha_{10} child_i$$

Table 7 presents the results of the model with the use of the complete sample and random sub-sample, in columns 1 and 2. This was completed so as to check the robustness of the results of the complete sample (see table A1 for complete variable definitions and for additional information on them).

Table 7. Results of the Estimated TOBIT Model

Dependent Variable: WTP		Estimated Coefficients:	
Independent Variables:	Description	(1)	(2)
visits	(annual visits to the Doubs)	0.425	0.273
		(1.39)	(0.73)
distance	(distance to the Doubs)	-0.486	-0.749
		(-0.86)	(-1.06)
age	(age of the respondent)	-0.872**	-0.216
		(-2.00)	(0.42)
gender	(dummy on gender)	3.482	32.987
		(0.24)	(1.31)
education	(dummy on tertiary level	-10.996	-12.754
	education)	(-0.71)	(-1.42)
income	(income of the respondent)	11.204***	17.236***
		(3.45)	(2.80)
live	(number of years lived in	4.589	-3.793
	canton)	(0.82)	(-0.19)
memberdonate	(dummy on member/donate to	61.357***	52.767***
	environmental organisations)	(4.46)	(3.22)
adult	(number of adults that live in	-2.332	-3.500
	the household)	(-0.34)	(-0.32)
child	(number of children that live	-8.223	-12.410
	in the household)	(-1.10)	(-1.05)
constant		48.295	76.606
		(1.24)	(0.64)
Obs.		75	47
Likelihood Ratio Chi-Square		35.88	20.48
Probability>Chi-Squared		0.0001	0.0250

Note: The t-statistics are provided in the brackets and *,**,*** indicates whether the variab -le is influential at the 10, 5, 1 % levels of significance.

The likelihood ratio chi-squares of 35.88 and 20.48 with p-values of 0.0001 and 0.0250 indicate that the overall fit of the models are significantly greater than models that would have contained no independent variables. This implies that the correct information on the influences of the respondents' WTP was obtained. From the coefficents, only 3 of them are estimated to be significantly different from zero, namely age with the use of the random sub-sample, and income and member donate in both cases. This is probably due to the small sample size. Despite this, all coefficients are discussed with respect to their sign below. It should be noted that the constants of these models may be interpreted as the mean/median WTP. They are different in comparison to those estimates that were obtained with the use of the Kaplan-Meier Product Line Estimator. This is evidence to show that the value of the mean/median WTPs may be influenced by the method used to estimate them and it is because of this that they should not be treated as if they were definite. The variables *visits, distance, age, adult*

and *child* are continuous variables. The variable *visits* shows that an increase in a respondent's visitation of the Doubs by one time per year increases the predicted value of WTP by 0.43 CHF, with the direction of this influence not changing in the second model. This is in accordance with the intuition on this variable that the more a respondent visits the Doubs, the more they should be WTP to conserve it as they have more information on the benefits of the Doubs. The variable *distance* shows that an increase in the distance of a respondent's place of residence to the Doubs by 1 kilometre, decreases the predicted value of WTP by 0.47 CHF, with the direction of this influence not changing in the second model. Although this influence is not significant, it is in accordance with the theory on this variable that the farther away an individual resides from an environmental amenity, the less they should value it. The variable *age* shows that an increase in the age of a respondent by 1 significantly decreases the predicted value of WTP by 0.87 CHF which is in accordance with the theory on this variable. The direction of this effect could be due to a number of reasons though the most prominent reason seems to be that of environmental conciousness in the sense that it may be greater in younger individuals. The variable *adult* shows that an increase in the size of a respondents household by 1 adult decreases the predicted value of WTP by 2.33 CHF, and the variable *child* shows that an increase in the size of a respondents household by 1 child decreases the predicted value of WTP by 8.22 CHF. It may therefore be assumed that larger households are WTP less of an increase in their cost of electricity. This could be due to a number of reasons, though the most prominent reason seems to be that these households may have additional costs that smaller households do not have, such as financing the mortage or rent of a larger house. The variables *gender, memberdonate* and *education* are dummy variables. The variable *gender* shows that the predicted value of WTP increases by 3.48 CH if the respondent is a female with the direction of the effect not changing in the second model. This result is in accordance with the theoretical expectation of this variable and may be exaplained by a number of psychological reasons, such as a difference in the preference of risk between the two genders. The variable *memberdonate* shows that the predicted value of WTP significantly increases by 61.36 CHF if the respondent is a member or donates to an environmental organisation, and the direction of its influence does not change in the second model. This is in accordance with the intuition on this variable that these individuals should report a larger WTP taking into account the implied larger concern that they attach to environmental issues. The variable *education* shows that the predicted value of the WTP of a respondent that has attained a tertiary level of education decreases by 11 CHF and this influence is not altered in the second model. This is not in accordance with the theory on this variable. A respondent that has attained a higher level of education may be more patient, and may therefore be prepared to accept a higher cost today to ensure that they benefit from the Doub's conservation in the future. The effect of this variable may be connected to the fact that more than 80 percent of the respondents reported that they had attained a tertiary level education and thus momentously influenced the results on this variable. The variables *income* and *live* are categorical variables. The

variable *income* shows that an increase in income by one category significantly increases the predicted value of WTP by 11 CHF. Its influence does not change in the second model and it is in accordance with the theory on this variable. The variable *live* indicates that an increase in the number of years that a respondent has lived in the canton of Neuchâtel increases the predicted value of WTP by 4.59 CHF. The direction of the effect is altered in the second model and may have been influenced by the 80 percent of respondents that reported that they had lived in the canton of Neuchâtel for 20 years and plus. This result is in accordance with the intuitive expectation that the more years an individual has lived in the canton the more they should be concerned about its surroundings. On the whole, it may be stated that the information that was obtained was in accord with their theoretical and intuitive forecasts with the variables *age, income* and *memberdonate* seeming to be the most influential in shaping the WTP of a respondent.

Discussion and Conclusion

The intent of this analysis was to estimate the value that the inhabitants of the canton of Neuchâtel attach on the preservation of the Doubs so as to broaden the information that was contained on it. This was accomplished with the use of the CVM and with the incorporation of an open-ended question to inquire into the value that these inhabitants attach on it. In assessing the questionnaire and information that was provided by the respondents, it is plausible to assert that the questionnaire was clear, interpretable and credible, and that the information that was provided was in accordance with its theoretical and intuitive expectations.

The results indicate that the inhabitants of the canton of Neuchâtel are on the whole concerned about the condition of the Doubs and are WTP on average an additional 55 CHF on their annual electricity bill to have the operations of the hydro-electric power companies regulated. These regulations would act so as to improve the condition of the Doubs and thus increase the annual benefits that the inhabitants receive from it by up to 9.63m CHF. This estimate is considerable, though additional research on the Doubs would be necessary, taking into account that it only reflects the value that the inhabitants of the canton of Neuchâtel attach on the preservation of the Doubs and that it was only this characteristic of the river that was examined.

These estimates could be used as a guide by the authorities of the canton of Neuchâtel and other relevant authorities in the development of environmental policies that concern the Doubs. This is due to the limitations of this analysis which are related to the effect that sample selection bias may have had on the end results, the use of one group to estimate the preservation value of the Doubs, and the fact that there does not exist an absolute method with which to estimate the value of an environmental amenity. There is therefore "no reason to think that ... [environmental problems] ... should be resolved within narrow

disciplinary boundaries" (Norton 1995, p. 126). The regional and cross-border nature of the Doubs also renders additional research on it necessary, as it would provide information on the benefits that are received by the inhabitants that reside in the other cantons and in France. It could be stated that the dismal state of the Doubs could be due to a shortage of information on its value that would be required to initiate cooperation between the authorities of Switzerland and France. Hence, a more active approach should be undertaken on both sides of the river to ensure the conservation of this irreplaceable amenity.

APPENDIX

SONDAGE - LE DOUBS

Depuis environ 50 ans, l'état de santé du Doubs s'est détérioré. Il y a plusieurs facteurs en cause mais les défenseurs de la rivière affirment que c'est essentiellement dû:

- Au flux des eaux usées des ménages non-traitées dans le passé;
- Au flux des eaux usées d'un certain nombre de ménages non-traitées actuellement;
- Au flux de produits chimiques dû à un mauvais traitement des eaux usées;
- Au flux de produits toxiques et de métaux lourds causé par des industries et des restes de munitions de la Deuxième Guerre Mondiale;
- Au flux de micropolluants utilisés dans l'agriculture et les activités de sylviculture;
- À la gestion des eaux par les compagnies d'énergie hydraulique.

Ces activités ont eu un effet néfaste sur le Doubs et ont mené à une perte de biodiversité (touchant également les poissons) et à la propagation d'algues. Il a également été mentionné que ce comportement menace l'existence du Doubs, car il pourrait mener à sa mort écologique.

Il n'y a pas qu'une seule solution pour la préservation du Doubs. Nous pensons cependant que parmi celles la conservation de la rivière inclurait une régulation stricte des compagnies d'énergie hydraulique et que ceci provoquerait éventuellement une augmentation des coûts de l'électricité.

Supposez que cette solution est choisie et qu'elle améliorera l'état du Doubs. Elle sera financée par vous et les autres habitants des régions suisses et françaises avoisinant la rivière par une augmentation fixe de votre facture d'électricité. Plus le financement sera élevé, plus l'état écologique du Doubs s'améliorera dans le futur.

Pour toute question concernant le questionnaire, vous avez la possibilité de me contacter par téléphone ou par e-mail:

Tél: 0762727037 & E-mail: nikola.jovanoski@unine.ch

Q1. Vous sentez-vous concerné par l'état de santé écologique du Doubs ?

- Oui
- Non

Q2. Utilisez-vous le Doubs à des fins récréatives?

- Oui
- Non

Q3. Pour quels types d'activités récréatives utilisez-vous le Doubs?

- Natation
- Bateau
- Pêche
- Pique-nique
- Randonnées
- Autre:

Q4. Estimez-vous important de savoir que le Doubs pourrait être utilisé pour des activités récréatives telles que celles citées ci-dessus ?

- Pas important du tout
- Peu important
- Neutre
- Important
- Très important

Q5. Estimez-vous important de savoir que les générations futures pourraient utiliser le Doubs pour des activités récréatives ?

- Pas important du tout
- Peu important
- Neutre
- Important
- Très important

Q6. Estimez-vous important de savoir que le Doubs est en bonne condition écologique ?

- Pas important du tout
- Peu important
- Neutre
- Important
- Très important

Q7. Selon vous, que pourrait être fait pour améliorer les conditions du Doubs ?

- Construire des centres de recyclage des eaux usées
- Construire plus de traitement de l'eau
- Réguler la gestion de l'eau des centrales hydro-électriques
- Amender les ménages et les entreprises qui polluent la rivière
- Investir dans des sources d'énergie alternatives
- Réguler le comportement de l'agriculture et des activités forestières proche de la rivière
- Toutes les réponses citées ci-dessus
- Autre:

Q8. Comment pensez-vous qu'une amélioration de l'état écologique du Doubs pourrait vous bénéficier directement et indirectement ?

- Amélioration de la santé
- Amélioration des conditions de vie
- Augmentation du tourisme
- Augmentation du revenu
- Augmentation des logements et du prix du terrain
- Sachant que vous pourriez l'utiliser le Doubs à l'avenir
- Sachant que les générations futures pourraient l'utiliser le Doubs
- Sachant qu'il y a de l'eau propre et un écosystéme en bonne santé (dont les poissons)
- Toutes les réponses citées ci-dessus
- Autre:

Q9. Combien de fois par année visitez-vous le Doubs ?

Q10. Allez-vous vers d'autres rivières ou lacs pour des activités récréatives ?

- Oui
- Non

Q11. Supposons que la réglementation des sociétés hydroélectriques dans leur gestion de l'écoulement de l'eau du Doubs à l'aide d'un fonds financier apporté par le public pourrait améliorer l'état du Doubs. Quel coût maximal seriez-vous prêt à payer en plus de votre actuelle facture d'électricité annuellement pour s'assurer que les compagnies d'énergie hydroelectrique soient forcées à respecter certaines conditions dans leur gestion de l'écoulement de la rivière? [Note. Veuillez s'il vous plaît vous concentrer sur votre budget personnel en répondant à cette question.]

- 0 CHF
- 5 CHF
- 10 CHF
- 20 CHF
- 50 CHF
- 100 CHF
- 150 CHF
- 200 CHF
- 250 CHF
- 300 CHF
- 350 CHF
- 400 CHF
- 450 CHF
- 500 CHF
- 750 CHF
- Autre:

Q12. Si vous avez répondu 0 CHF, pourriez-vous expliquer pourquoi ?

- Je préfère utiliser cet argent ailleurs
- Je n'ai pas les moyens pour payer pour ça
- Ce n'est pas ma responsabilité
- Je ne pense pas que cette solution améliorera l'état du Doubs
- Autre:

Q13. Pourriez-vous s'il vous plaît indiquer votre année de naissance?

Q14. Pourriez-vous s'il vous plaît indiquer votre sexe ?

- M
- F

Q15. Pourriez-vous s'il vous plaît indiquer votre niveau d'éducation ?

- Ecole obligatoire
- Degré secondaire - formation générale
- Degré secondaire - formation professionnelle
- Degré tertiaire - formation professionnelle supérieure
- Degré tertiaire - haute école spécialisée
- Degré tertiaire - haute école universitaire

Q16. Pourriez-vous s'il vous plaît indiquer dans quel secteur vous travaillez ?

- Agriculture
- Industrie
- Artisanat
- Commerce
- Services
- Secteur public
- Inactif
- Autre:

Q17. Pourriez-vous indiquer votre code postal ?

Q18. Pourriez-vous s'il vous plaît indiquer le nombre d'années que vous avez vécues dans le canton de Neuchâtel?

- 0-2 années
- 2-5 années
- 5-10 années
- 10-20 années
- 20 plus années

Q19. Pourriez-vous s'il vous plaît indiquer le nombre d'adultes et d'enfants vivent dans votre ménage ?

- Adultes (plus de 18 ans):
- Enfants (moins de 18 ans):

Q20. Pourriez-vous s'il vous plaît indiquer votre revenu mensuel? Cet information est importante car elle me permettra de savoir est-ce que les résultats de l'étude sont utiles.

- 0 - 3000 Francs
- 3001 - 4000 Francs
- 4001 - 5000 Francs
- 5001 - 6000 Francs
- 6001 - 7000 Francs
- 7001 - 8000 Francs
- plus de 8000 Francs

Q21. Pourriez-vous indiquer si vous faites partie d'une organisation environnementale et/ou si vous faites des dons à des organisations environnementales ?

- Oui
- Non

Q22. Merci d'avoir pris le temps de remplir le questionnaire. Si vous avez une remarque ou une suggestion que vous aimeriez laisser en ce qui concerne l'enquête, merci de la mentionner ci-dessous. Si vous êtes également intéressés par cette étude, merci de laisser votre adresse email et nous vous ferons parvenir une copie du rapport.

Table A1. The Definitions of the Variables

Willingness-to-Pay *(wtp)*: measures a respondents WTP an increase in their annual electricity bill to regulate the operations of the hydroelectric power companies.
Concern *(concern)*: a dummy variable on whether the respondent is concerned with the condition of the Doubs with 1 = concerned and 0 = not concerned.
Recreational Use *(recreationaluse)*: a dummy variable on whether the respondent uses the Doubs for recreational purposes with 1 = use and 0 = not use.
Bequest *(beqimportance)*: a categorical variable on the importance a respondent attaches on knowing that future generations may use the Doubs. A higher value indicates a greater importance with 1 = not important at all and 5 = very important.
Existence *(eximportance)*: a categorical variable on the importance a respondent attaches on knowing that the Doubs exists. A higher value indicates a greater importance with 1 = not important at all and 5 = very important.
Future Use *(fuimportance)*: a categorical variable on the importance a respondent attaches on knowing that they may use the Doubs in the future. A higher value indicates a greater importance with 1 = not important at all and 5 = very important.
Number of Visits Per Year *(visits)*: measures the number of times a respondent visits the Doubs per year.
Visit Substitute Sites *(substitute)*: a dummy variable on whether the respondent visits other lakes/rivers for recreational purposes with 1 = yes and 0 = no.
Age *(age)*: measures the age of the respondent.
Gender *(gender)*: a dummy variable where 1 = female and 0 = male.
Education *(education)*: a dummy variable on whether the respondent has attained a tertiary level of education with 1 = yes and 0 = no.
Distance *(distance)*: measures the distance from the settlement of the respondent to the Doubs and was calculated with the help of google maps.
Years Lived in Canton *(live)*: a categorical variable on the number of years the respondent has lived in the canton. A higher value indicates more years with 1 = 0-2 years and 5 = 20+ years.
Adults in Household *(adult)*: measures the number of adults - at age 18 or above - that live in the respondent's household.
Children in Household *(child)*: measures the number of children - at age 18 or below - that live in the respondent's household.
Income *(income)*: a categorical variable on the income of a respondent. A higher value indicates a higher income with 1 = 0-3000 CHF and 7 = 8000+ CHF.
Member or Donate *(memberdonate)*: a dummy variable on whether the respondent is a member or makes donations to environmental organisations with 1 = yes and 0 = no.

Table A2. Kaplan-Meier Product Line Estimator - Measured Values Complete Sample

Without Protests				With Protests			
WTP (C_j)	No. of Respondents	n_j	$S(C_j)$	WTP (C_J)	No. of Respondents	n_j	$S(C_j)$
0	3	72	0.96	0	14	72	0.83
5	8	64	0.85	5	8	64	0.74
10	7	57	0.76	10	7	57	0.66
20	15	42	0.56	20	15	42	0.48
50	24	18	0.24	50	24	18	0.20
100	11	7	0.09	100	11	7	0.08
150	2	5	0.06	150	2	5	0.05
200	3	2	0.02	200	3	2	0.02
250	1	1	0.01	250	1	1	0.01
300	1	0	0	300	1	0	0

Table A3. Kaplan-Meier Product Line Estimator - Measured Values Random Sample

Without Protests				With Protests			
WTP (C_j)	No. of Respondents	n_j	$S(C_j)$	WTP (C_J)	No. of Respondents	n_j	$S(C_j)$
0	0	47	1	0	9	47	0.83
5	3	44	0.93	5	3	44	0.78
10	5	39	0.82	10	5	39	0.69
20	11	28	0.59	20	11	28	0.50
50	14	14	0.29	50	14	14	0.25
100	9	5	0.10	100	9	5	0.08
150	1	4	0.08	150	1	4	0.07
200	2	2	0.04	200	2	2	0.03
250	1	1	0.02	250	1	1	0.01
300	1	0	0	300	1	0	0

Tables A4. Test Statistics for the Two-Sample T-Test on Bequest Importance (Group 1 & 2)

Group	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
1	35	4.02	0.12	0.74	3.77 - 4.28
2	20	3.6	0.16	0.75	3.24 - 3.95
Combined	55	3.87	0.10	0.77	3.66 - 4.08
Difference		0.42	0.21		0.01 - 0.84

Note: The t-stat and p-value are 2.040 and 0.023. It may be concluded at the 5% level of significance that the mean importance of Group (1) on the bequest of the Doubs is greater than the mean importance of Group (2).

Tables A5. Test Statistics for the Two-Sample T-Test on Existence Importance (Group 1 & 2)

Group	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
1	35	4.22	0.08	0.49	4.06 - 4.39
2	20	3.35	0.22	0.98	3.18 - 4.11
Combined	55	4.01	0.10	0.75	3.81 - 4.22
Difference		0.57	0.19		0.17 - 0.97

Note: The t-stat and p-value are 2.906 and 0.002. It may be concluded at the 1% level of significance that the mean importance of Group (1) on the existence of the Doubs is greater than the mean importance of Group (2).

Tables A6. Test Statistics for the Two-Sample T-Test on Bequest Importance (Group 1 & 3)

Group	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
1	35	4.02	0.12	0.74	3.77 - 4.28
3	31	4.32	0.12	0.70	4.06 - 4.57
Combined	66	4.16	0.09	0.73	3.98 - 4.34
Difference		-0.29	0.17		-0.65 - 0.06

Note: The t-stat and p-value are -1.641 and 0.052. It may be concluded at the 10% level of significance that the mean importance of Group (1) on the bequest of the Doubs is less than the mean importance of Group (3).

Tables A7. Test Statistics for the Two-Sample T-Test on Existence Importance (Group 1 & 3)

Group	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
1	35	4.22	0.08	0.49	4.06 - 4.39
3	31	4.58	0.09	0.50	4.39 - 4.76
Combined	66	4.39	0.06	0.52	4.26 - 4.52
Difference		-0.35	0.12		-0.59 - 0.10

Note: The t-stat and p-value are -2.880 and 0.002. It may be concluded at the 1% level of significance that the mean importance of Group (1) on the existence of the Doubs is less than the mean importance of Group (2).

Tables A8. Test Statistics for the Two-Sample T-Test on Bequest Importance (Group 2 & 3)

Group	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
2	20	3.6	0.16	0.75	3.24 - 3.95
3	31	4.32	0.12	0.70	4.06 - 4.57
Combined	51	4.03	0.11	0.79	3.81 - 4.26
Difference		-0.72	0.20		-1.13 - - 0.30

Note: The t-stat and p-value are -3.487 and 0.000. It may be concluded at the 1% level of significance that the mean importance of Group (2) on the bequest of the Doubs is less than the mean importance of Group (3).

Tables A9. Test Statistics for the Two-Sample T-Test on Existence Importance (Group 2 & 3)

Group	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
2	20	3.65	0.22	0.98	3.18 - 4.11
3	31	4.58	0.09	0.50	4.39 - 4.76
Combined	51	4.21	0.11	0.85	3.97 - 4.45
Difference		-0.93	0.20		-1.35 - - 0.51

Note: The t-stat and p-value are -4.446 and 0.000. It may be concluded at the 1% level of significance that the mean importance of Group (2) on the existence of the Doubs is less than the mean importance of Group (3).

Tables A10 and A11. Test Statistics for the Two-Sample T-Tests of Complete Sample

Concern	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
0	18	39.44	11.46	48.65	15.24 - 63.64
1	57	60.52	8.25	62.29	43.99 - 77.05
Combined	75	55.46	6.89	59.69	41.73 - 69.20
Difference		-21.08	16.06		-53.08 - 10.92

Note: The t-stat and p-value are -1.31 and 0.096. It may be concluded at the 10% level of significance that the mean WTP of those respondents that are not concerned about the Doubs is less than the mean WTP of the respondents that are.

Recreational Use	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
0	48	41.35	5.91	40.99	29.45 - 53.25
1	27	80.55	15.00	77.98	49.70 - 111.40
Combined	75	55.46	6.89	59.69	41.73 - 69.20
Difference		-39.20	13.70		-66.52 - -11.87

Note: The t-stat and p-value are -2.85 and 0.002. It may be concluded at the 1% level of significance that the mean WTP of those respondents that do not use the Doubs for recreational purposes is less than that of those that do.

Tables A12 and A13. Test Statistics for the Two-Sample T-Tests of Random Sample

Concern	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
0	4	42.50	21.63	42.72	-25.47 - 110.47
1	43	65.46	10.20	66.90	44.87 - 86.05
Combined	47	63.51	9.50	65.17	44.37 - 82.64
Difference		-22.96	34.27		-91.99 - 46.06

Note: The t-stat and p-value are -0.67 and 0.2531. It may not be concluded at any level of significance that the mean WTP of those respondents that are not concerned about the Doubs is less than the mean WTP of the respondents that are.

Recreational Use	Obs.	Mean	S.E.	S.D.	95% Confidence Interval
0	22	42.27	7.01	32.90	27.68 - 56.86
1	25	82.20	16.02	80.10	49.13 - 115.26
Combined	47	63.51	9.50	65.17	44.37 - 82.64
Difference		-39.92	18.32		-76.82 - -3.02

Note: The t-stat and p-value are -2.17 and 0.0173. It may be concluded at the 5% level of significance that the mean WTP of those respondents that do not use the Doubs for recreational purposes is less than that of those that do.

Table A14. Value of Preserving the Doubs

Sample		WTP (CHF)	Total Value (CHF)
Complete Sample	Without Protests	Median: 20-50	3.5m - 8.75m
		Mean: 55	9.63m
	With Protests	Median: 10-20	1.75m - 3.5m
		Mean: 47	8.23m
Random Sub-Sample	Without Protests	Median: 20-50	3.5m - 8.75m
		Mean: 62	10.85m
	With Protests	Median: 20	3.5m
		Mean: 52	9.1m

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