

THE FOREGONE RECREATION VALUE OF LAKE ÜLEMISTE

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Abstract

Since Soviet times Lake Ülemiste has been closed to public access. The current practice of Tallinn may entail unnecessary losses of benefits to the local population. The aim of this paper is to find the value of the foregone benefits. In order to find this value, a contingent valuation (CVM) survey was conducted involving a sample of the adult population of Tallinn.

According to the survey the average willingness to pay is 6.6 Euro and the recreational benefits foregone were estimated to 1.8 million Euros annually. In order to safeguard the quality of the drinking water, additional measures may be needed. Discounted over a 30 year period allows investments of a maximum of 26 million Euro. Applying the current investment plan of Gothenburg to Tallinn shows that the recreational value of opening the lake to the public is sufficiently large to cover Gothenburg's coal filter investments to be carried out in Tallinn.

Keywords: contingent valuation, recreation value, drinking water reservoir

JEL Classification: C25, Q25, Q26, Q51

1. Introduction

It has been found that provision of parks and recreational areas in urban neighbourhoods have significant positive health impacts on the urban population (see e.g. Foster *et al.*, 2005, Duncan and Mummery, 2004 and Suminski *et al.*, 2005). In order to ensure that cities recognise the positive values of green area provision, the EU has supported various initiatives, including the COST Action C11 and an internet site about green structure. However, not all recreational areas are open to the public. Located only 2 kilometres from the city centre, Lake Ülemiste, which is the largest lake in the Tallinn area has since the Soviet times been closed to the public (RT I 1994, 40, 655). Recently the restrictive zone that surrounds the lake was extended by a decision of the Environmental Board (Tallinna vesi, 2010). The main motivation is to protect Tallinn's drinking water reservoir.

In comparison to surface water reservoir protection policies in other countries, including neighbouring Finland and Sweden, the protective measures of Lake Ülemiste seem exaggerated. In Sweden, the City of Gothenburg, which is of a similar size as the City of Tallinn, is supplied by drinking water from Delsjöarna Lakes and the River Göta Älv (Göteborgsregionen, 2003). These water bodies are open to the public. While Delsjöarna Lakes are located in a forest area, the River Göta Älv serves as a fairway and there are polluting industries located in its vicinity. This does not imply that Sweden does not protect drinking water reservoirs, but

Swedish policies do not regard recreation use as a threat. Protective measures include restrictions in the use of pesticides, petroleum products, spread of manure, installation of sewage systems and waste dumping (NFS, 2003:6).

Judging from practices elsewhere, the restrictions that are imposed on Lake Ülemiste imply a loss in welfare to the population of Tallinn. The aim of this paper is to find the value of the foregone benefits and also to discuss the costs of possible additional water protection measures. However, this study does not investigate the range of additional costs that may stem from recreational use of Lake Ülemiste. Instead data on the costs of additional water protection measures are based on current plans of the City of Gothenburg (Göteborgs stad, 2010). The benefits foregone are measured according to what inhabitants themselves would be willing to pay to make the lake accessible for recreation. In order to find the value of the loss in benefits, a contingent valuation (CVM) survey was conducted in the autumn 2010. Previous research that has estimated recreational values of lakes have generally applied travel cost estimates (see e.g. Fleming and Cook, 2008, Okrazai, 2008). CVM studies on lakes have instead set out to estimate the willingness to pay for an improvement in the water quality of the lake (see e.g. Carson and Mitchell, 1993 Monarchova and Gudas (2009). Since Lake Ülemiste is closed, the travel cost method has not been available for finding the recreational value of this study.

In the next section we present a general overview about non-market values. After that, in Section 3, we report the details of the survey and provide descriptive statistics. In section 4 we carry out the statistical analysis and estimate the benefits foregone. Section 5 presents the investment programme of Gothenburg and uses cost-benefit analysis to assess whether the investments of Gothenburg can be motivated in Tallinn. In section 6 we conclude the study.

2. The value of a non-market resource

The value of a good or a service is determined either by markets or assessed by different methods developed for revealing individual preferences for non-marketed goods. Value, according to economic theory, relates to the utility individuals derive from goods and services. The choices individuals make reflect their preferences and concerns. When individuals make a choice, either in relation to what to buy or how to spend their time, they appraise the value they will receive from a particular choice. Many goods are not subject to market transactions and they can be enjoyed for free, e.g. bird watching and swimming in a lake. In his seminal paper, Krutilla (1967) went even further by suggesting that people receive utility from natural assets just because they exist. Thus, utility may originate from the pure knowledge of conservation of a certain wilderness area. Through human choices the value of these activities can be assessed. For an overview of non-market valuation see e.g. Smith, 1993 or Freeman, 2003.

The closure of Lake Ülemiste implies that the recreational value and possibly the aesthetic value of the lake currently are cut off from use. Allowing recreational use of Lake Ülemiste would imply an increase in the indirect use value. Table 1

classifies the types of economic values that can be attributed to the benefits of Lake Ülemiste.

Table 1. The economic values of Lake Ülemiste and their expressions

Economic value	Category	Typical expressions of the value
Non-use value Existence value	General ecological	Provision of conditions for life Conservation of species
Non-use value Intrinsic value	General ecological	Provision of water Preservation of pure water resources
Non-use value Intrinsic value	Biotic regulation	Conservation of species and genetic resources Provision of multiplicity of ecological systems
Non-use value Bequest value	Future value	Provision of biodiversity and pristine environment in the future
Use value Option value	Future value	Preservation to allow future drinking water supply, recreation, research, etc.
Indirect use value	Human use of ecosystem services	Regulation of water, prevention of erosion etc.
Indirect use value	Recreational (including health impacts)	Supply of recreational services (e.g. swimming, skating, boating, walking on the shoreline)
Indirect use value	Educational and scientific	Opportunities for educational and research work
Indirect use value	Cultural-historical	Lake mythology
Indirect use value	Aesthetic	Recognizing beauty of landscapes and natural objects
Direct use value	Agricultural	Fishing
Direct use value	Industrial	Production of drinking water

The contingent valuation method (CVM) is a survey method that seeks to elicit people’s preferences for changes in non-market good provision by finding the amount of money people are willing to pay in order to receive the change in question. The value attached to the object by the respondents in the form of the willingness to pay is contingent in relation to the constructed or simulated market (or market scenario) in the questionnaire (Portney, 1994). If there is no actual market for some goods, it has to be created hypothetically. The hypothetical scenario is then presented to people and they are asked how much money they would agree to give up if the change was undertaken, alternatively to avoid the change. Theoretically, the maximum amount of money an individual is willing to pay for a welfare increasing change is equivalent to the amount that he or she would give up while keeping his or her utility constant (Freeman, 2003).

The indirect approach or revealed preference (RP), estimates the value by studying human behaviour in complementary markets, i.e. money and time spent on travelling to a lake (travel cost method) or how the local environment affects housing prices in urban areas (hedonic model). Use values can be estimated by direct and indirect methods. However, since human behaviour is a prerequisite for the travel cost and hedonic approaches they cannot elicit non-use values. Non-use values can be estimated only by using direct methods (Freeman, 2003).

3. Ülemiste CVM Survey

As a part of their undergraduate studies in Economics and Business Administration at Tallinn University of Technology, students taking environmental economics were asked to distribute ten questionnaires each to a sample of different age groups representing the 18+ population of Tallinn. Because participants received course credits, response rates were high: 95 per cent. In total, 1,523 questionnaires were returned out of the 1,600 that were originally distributed. Since 282 questionnaires lacked a willingness to pay (WTP) statement, 1,241 replies remained for further analysis. Apart from overrepresentation of the two youngest age groups and underrepresentation of age groups above 60 years, the sample is representative to the Tallinn population, see Figure 1, below. Since the total deviation with respect to age groups is only about 4.7 per cent, weighting was not undertaken prior to analysis.

The questionnaire used an open ended WTP question including a reminder that the respondent should consider his or her budgetary means when replying. In order to reduce the complexity of stating the recreational value of a lake area the respondents have never visited, the WTP question was stated in terms of the annual willingness to pay for additional water protection measures that would certify maintenance of drinking water quality.

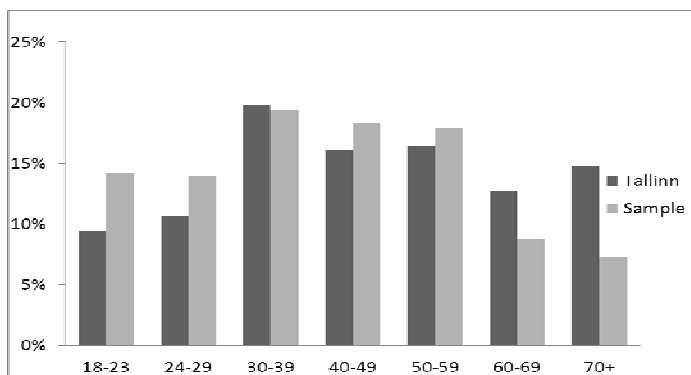


Figure 1. Age distribution of the sample and in Tallinn. Sources: statistics Estonia and Ülemiste CVM survey.

The survey included three attitude questions about the idea of opening Lake Ülemiste for the public. The questions were:

Q1: Do you think, that opening Lake Ülemiste for the public does not jeopardise the quality of the drinking water in Tallinn?

Q2: Do you support the idea that Lake Ülemiste should be opened for Tallinn inhabitants?

Q3: In case Lake Ülemiste was opened, would you use the opportunity to spend free time at the lake and its surroundings?

Table 2. Attitudes towards opening Lake Ülemiste

	Q1	Q2	Q3
Yes	28.5%	32.1%	34.6%
No	51.7%	56.8%	49.4%
Don't know	19.6%	11.0%	16.0%
Total	1,520	1,522	1,523

There were relatively many “don’t know” replies to all three attitude questions, see Table 2. The first question whether recreational use would be a threat to water quality had the highest share of “don’t know” replies. It also seems as judging whether or not to visit Lake Ülemiste if made accessible (Q3), received a high share of “don’t know” replies.

About one in three supports the idea of recreational access to Lake Ülemiste while more than one half of the respondents oppose to the idea. The share of those opposed to opening the lake (“no” to Q2), is higher than the share of those who express concern for the drinking water (“no” to Q1). It is interesting to compare the result to a survey about attitudes to bathing in Delsjöarna Lakes. In Gothenburg, the attitudes are much more favourable towards recreational use, possibly because the lakes have never been restricted to public access. About 65 per cent of the respondents were of the opinion that bathing should be allowed everywhere and almost 90 per cent reported that they had visited Delsjöarna Lakes (Morrison and Bost, 2008).

In the Ülemiste CVM survey 27 per cent of those respondents that were opposed to the suggestion of opening the lake to the public, stated that they would not visit the lake if it was opened, but still reported a positive WTP. The interpretation of these responses, which make up about 2 per cent of the observations, could be that the concerns about a potential negative impact on drinking water quality from recreational use results in a willingness to pay for precautionary measures, if public access is allowed.

The average willingness to pay of the 1,241 respondents who gave a WTP reply is 6.6 Euro per year. Assuming that those who did not fill in a WTP response had stated a zero WTP gives an average WTP of 4.3 Euro, which is about 65 per cent of

the mean of those who had filled in WTP statements. Table 3 shows the average WTP with respect to socio-metric variables. According the averages, men were prepared to pay more than women. It is not possible to differ between the WTP of those with secondary and higher education. However, those who have primary and secondary technical education generally gave lower WTP values than those with the two aforementioned education levels. While younger age groups have a higher average WTP than those in older age groups, those with higher incomes generally gave a higher average WTP than those belonging to lower income groups.

Table 3. Willingness to pay (WTP) with respect to socio-metric variables

		Average WTP, €	Difference from total average, %
Gender	Male	8,2	124,4
	Female	5,3	80,6
Education	Primary	4,0	61,2
	Secondary	7,3	110,4
	Secondary technical	5,2	78,6
	Higher	7,3	110,0
Age	18-23	8,7	131,9
	24-29	8,3	125,8
	30-39	7,5	114,0
	40-49	6,4	96,6
	50-59	4,4	67,4
	60-69	5,2	78,4
	> 70	4,1	61,5
Average monthly income (net), €	<128	3,6	55,0
	128-255	4,6	69,7
	256-383	4,2	64,0
	384-511	5,8	88,2
	512-703	7,0	106,2
	704-958	10,3	155,5
	959-1278	6,5	97,9
	>1278	12,3	185,7
Total average		6,6	100,0

4. Statistical analysis

The statistical analysis of data is carried out in two steps. In the first step we use a binary logit regression to allow us to assess the influence of socio-metric variables to the decision to pay or not to pay. In the second step, an OLS regression is applied to the sub-sample that has a positive WTP in order to determine the relationship between the stated amount and the socio-metric variables. Finally the positive WTP replies are used as an input for finding the demand curve and the consumer surplus.

4.1. Determination of a positive willingness to pay

Since survey data fits a standard logistic distribution, a logit-model is applied for describing the relationship between the binary dependent variable and the explanatory variables. The probability (P_i) that an individual states a positive WTP is expressed as:

$$P_i = \Pr(y_i = 1 | X_i) = \frac{1}{1 + e^{-\beta'X_i}} \quad (1)$$

where y_i is the binary dependent variable: ($y_i=1$, WTP>0, and $y_i=0$, WTP=0), X_i is the vector of independent variables and β_i is the vector of parameters.

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 GENDER + \beta_2 AGE + \beta_3 INCOME + \beta_4 EDUCATION + u_i \quad (2)$$

where $\frac{P_i}{1-P_i}$ is the odds ratio, $\ln\left(\frac{P_i}{1-P_i}\right)$ is the log odds ratio and u_i is the error term, which is assumed to have a zero mean.

The interpretation of the resulting logit model parameters is not straightforward, as the estimated probability is not a linear function of the parameters. It is only possible to estimate the direction of the correlation, i.e. in case $\beta_i > 0$ and that the value of X_i is increasing the probability increases, and vice versa. By using the odds ratio there will be a direct relationship between the change and its influence on the dependent variable. Table 4 shows the results of the regression.

Table 4. The influence of sociometric variables on WTP >0, logit model

	Coeff (β)	S.E.	Wald	Probability	Exp(β)
Constant	0.013	0.257	0.003	0.959	1.013
Gender	-0.078	0.124	0.399	0.527	0.925
Age	-0.182	0.034	29.316	0.000	0.834
Income	0.050	0.035	2.108	0.146	1.052
Education	0.105	0.072	2.143	0.143	1.111

According to the logit regression, age is the only statistically significant parameter and it is significant on the 1 per cent level. The negative β_1 implies that the choice of stating a positive WTP depends negatively on age. The log odds ratio that is shown in the column $\text{Exp}(\beta)$ shows that the increase in age by one age group reduces the probability of a positive WTP by 0.834 times. Individuals belonging to the oldest age group (70+) are $0.834^7=0.281$ times less likely to state a positive WTP than individuals belonging to the youngest group of 18-23 years.

The significant influence of age on the payment decision is potentially explained by the fact that young people have grown up in the free Estonia and are therefore more prone to take their rights for granted. Those who grew up during the Soviet time are more accustomed to restrictions and might therefore have higher acceptance for the closure of the lake.

4.2. Influence of socio-metric variables to the willingness to pay amount

In the second step, we examine the influence of the socio-metric variables to the amount of WTP. The subsample of positive WTP is used in the following OLS regression model:

$$\ln(WTP) = B_0 + B_1 GENDER + B_2 \ln(AGE) + B_3 \ln(INCOME) + B_4 \ln(EDUC) + u_i \quad (3)$$

where gender is a dummy variable (male=1, female=0) and all other variables are categorical variables.

Table 5 shows the regression result:

Table 5. The influence of socio-metric variables on the WTP amount, OLS model

	Coeff(B)	S.E.	t-ratio	Probability	95% conf. interval	
Constant	3.915	0.206	19.006	0.000	3.511	4.320
Gender	0.076	0.111	0.689	0.491	-0.142	0.294
Age	-0.203	0.094	-2.156	0.031	-0.388	-0.018
Income	0.411	0.116	3.547	0.000	0.183	0.638
Education	0.226	0.170	1.328	0.185	-0.108	0.560
Adj R ²	0.19					

The table shows that the size of the amount that people are willing to pay is statistically dependent on age and income. In correspondence to the previous regression result, age has a negative sign. Income is positively correlated to the sum that people are willing to pay, which is what we expect from theory. The influence from gender and education are not statistically significant. The goodness of fit (Adj. R²) is relatively low. However, a low R² is common in cross-sectional data.

4.3. Estimation of consumer surplus

In order to estimate the loss of the benefits from the closure of Lake Ülemiste we need to find the consumer surplus of the foregone recreational value. There are several different ways to calculate the consumer surplus. The open-ended WTP question that asks for the actual amount of willingness to pay allow us to calculate the consumer surplus by multiplying the average or median WTP obtained from the sample with the relevant population. However, such calculations tend to be inexact as they either overestimate or underestimate the consumer surplus and we decided to find the consumer surplus by fitting a demand curve. The construction of an aggregated demand curve for the adult population of Tallinn is based on the actual distribution of WTP amounts obtained in the survey. The results are generalized to the proportion of the population with positive WTP, which is 47.4 per cent i.e. about 155,800 persons 18 years of age or older in Tallinn on January 1st, 2010.

Based on the distribution of WTP, the exponential model is the most appropriate functional form, for presenting the demand curve, see equation (4)

$$WTP = ae^{-bX} \tag{4}$$

where *WTP* is the amount of willingness to pay, *X* is the number expressed in thousands of people willing to pay, and *a*, *b* the parameters under estimation. The results of the estimation, using the least squares method are shown in Table 6. The value of $R^2=0.96$ indicates a very high goodness of fit. In addition, both parameters are statistically significant.

Table 6. Parameter estimates of the demand curve, OLS regression ($R^2=0.96$)

	Coeff	S.E.	t-ratio	Significant	95% conf. interval	
A	69.01	0.640	108.12	0.000	67.76	70.26
B	0.038	0.000	76.821	0.000	0.039	0.037

Based on the estimation we can substitute *a* and *b* into equation (4) and obtain:

$$WTP = 69.01e^{-0.038X} \tag{5}$$

Figure 2 shows the graph of equation (5).

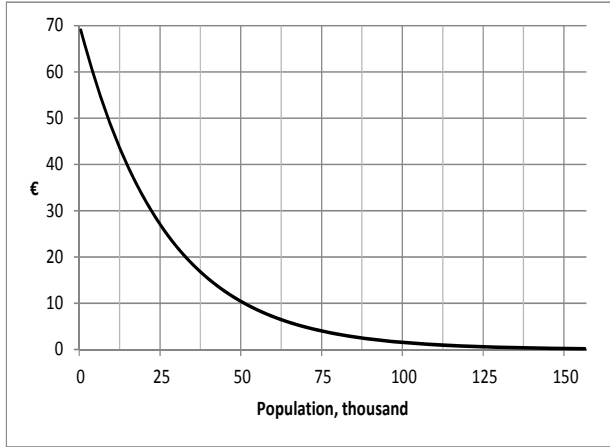


Figure 2. The demand curve of Tallinn population 18+ for getting access to Lake Ülemiste for recreational purposes.

The consumer surplus (CS) is the area below the demand curve. For this purpose we integrate the demand curve, see equation (6).

$$CS = \int_{x_1}^{x_2} WTP = \int_{x_1}^{x_2} ae^{-bx} = -\frac{a}{b} \left(e^{-bx_2} - e^{-bx_1} \right) dx \cong \frac{a}{b} \quad (6)$$

where $x_1=0$ and x_2 is the number of people with positive WTP (155.8 thousand). Replacing the values of the parameters a and b we find that the estimated consumer surplus is about 1.8 million Euro.

$$CS \cong \frac{a}{b} = \frac{69.01}{0.038} = 1816.05 \cong 1.8 \text{ million } \text{€} \quad (7)$$

The interpretation is that the closure of Lake Ülemiste entails an annual loss in welfare of the Tallinn population, which amounts to about 1.8 million Euros.

5. Costs of additional measures

The estimate of the consumer surplus indicates that the benefit foregone is relatively high according to the willingness to pay of the Tallinn population. Although Ülemiste water purification plant uses up-to-date technology for drinking water production (Tallinna Vesi 2010), we cannot exclude that recreational use affects raw water quality. If Lake Ülemiste is opened to the public, there might be a need to invest in additional water purification measures. In order to determine whether such investments are needed and their range requires further investigation and in-depth studies. However, such studies are out of the scope of the current paper. As a proxy of possible investments, we will report about the current plans in

Gothenburg and estimate whether similar investments would pass the cost benefit criteria for Tallinn.

Starting from the annual benefits of opening Lake Ülemiste of 1.8 million Euro, we calculate the benefits during the assessment period. According to the EU guidance on cost-benefit analysis during the programming period 2007-2013 investments in water and sewage plants should be evaluated during a 30 year period (European Commission, 2006). The same document suggests a discount rate of 5.5 per cent. Assuming that Lake Ülemiste will be opened in 2012, the sum of the net present value of benefits will be about 26 million Euro.

In Gothenburg there are plans to extend the Lackarebäck water purification plant to a capacity of 171,000 m³ water per day. Currently this plant has the same maximum capacity as Ülemiste water purification plant, i.e. about 120,000 m³ water per day. (Göteborgs stad, 2010 and Tallinna Vesi, 2010). Besides aiming at increasing the production capacity at Lackarebäck, Gothenburg will upgrade the water purification process. Investment costs of ultra-filters at Lackarebäck water purification plant have been estimated by the City of Gothenburg to approximately 70 per cent of 700 MSEK in 2009 value. The remaining i.e. 210 MSEK stands for the additional coal filter investments. The annual running costs are expected to be 9 and 1 MSEK respectively (Göteborgs stad, 2010, WSP 2010). The investment is calculated into Euros using the annual average SEK to Euro exchange rate, which was 10.62 in 2009 (Sveriges Riksbank, 2011).

Assuming that investments will be undertaken in Tallinn at the same pace as at Lackarebäck water purification plant, but scaled down to 70 per cent in order to consider the capacity increase, a provisional cost benefit analysis is carried out. Using the same assumptions as for benefits, we find that the sum of the net present value of ultra-filter investments and its running costs will be about 33 million Euros and the corresponding for coal filters about 15 million Euros, see Table 7. Assuming that Lake Ülemiste will be opened in 2012, the sum of the net present value of benefits will cover the investments and running costs of coal filters. Multiplying benefits by 0.65 thus taking into account non-responses, we receive a low level estimate. Using this low level benefit estimate will not alter the result.

Table 7. Provisional cost-benefit analysis, present values, Euro millions

Year	Discount factor	Investment		Running cost		Benefits
		Ultra	Coal	Ultra	Coal	
2011	1.000	2.234	13.840			
2012	0.948	5.753			0.062	1.706
2013	0.898	4.559		0.133	0.059	1.617
2014	0.852	0.393		0.126	0.056	1.533
2015	0.807	3.724		0.120	0.053	1.453
2016	0.765	3.530		0.227	0.050	1.377
2017	0.725	6.692		0.215	0.048	1.305
2018	0.687			0.408	0.045	1.237
2019	0.652			0.386	0.043	1.173
2020	0.618			0.366	0.041	1.112
2021	0.585			0.347	0.039	1.054
2022	0.555			0.329	0.037	0.999
2023	0.526			0.312	0.035	0.947
2024	0.499			0.296	0.033	0.897
2025	0.473			0.280	0.031	0.851
2026	0.448			0.266	0.030	0.806
2027	0.425			0.252	0.028	0.764
2028	0.402			0.239	0.027	0.724
2029	0.381			0.226	0.025	0.687
2030	0.362			0.214	0.024	0.651
2031	0.343			0.203	0.023	0.617
2032	0.325			0.193	0.021	0.585
2033	0.308			0.183	0.020	0.554
2034	0.292			0.173	0.019	0.525
2035	0.277			0.164	0.018	0.498
2036	0.262			0.156	0.017	0.472
2037	0.249			0.147	0.016	0.447
2038	0.236			0.140	0.016	0.424
2039	0.223			0.132	0.015	0.402
2040	0.212			0.126	0.014	0.381
Sum		26.885	13.840	6.360	0.945	25.800

6. Conclusions

Provision of recreational areas and safe drinking water are municipal tasks. In Tallinn, Lake Ülemiste, located only 2 kilometres from the city centre, is closed to the public in order to protect the city's main fresh water reservoir. In this paper we have reported on a contingent valuation (CVM) survey that was undertaken in order to estimate the foregone benefits of lake closure. According to the analysis of data about 1.8 million Euros are foregone annually. Another way to express this is that

the costs of drinking water production are 1.8 million Euros higher than measured by the annual costs of water treatment and its distribution to households.

The attitude questions of the CVM survey showed that about one in three supports the idea of allowing recreational access to Lake Ülemiste, more than one half oppose to the idea while the remaining respondents did not express any opinion. Out of those who filled in the willingness to pay question, 47 per cent were willing to pay for making Lake Ülemiste accessible to the public. The analysis showed that age is the only statistically significant variable determining whether a person chooses to state a zero or a positive willingness to pay. A potential explanation to why young people are more likely to contribute could be that young people have grown up in a free Estonia and are more conscious of their rights. The analysis of the determinants of the size of the amount that people are willing to pay showed that young people and people with higher income are prepared to pay more.

According to the city's practices there is no trade-off between drinking water provision and recreation use. This is in contrast to water protection policies elsewhere. A change in views would make possible public access to a valuable recreation area within the immediate neighbourhood of the city centre. Apart from the benefits that we have identified here, there may be additional positive impacts from public access to the Ülemiste area since provision of recreational areas in an urban setting have significant positive health impacts on the urban population. However, before taking such a decision further investigation and in-depth studies will be needed in order to determine whether opening the lake would require additional investments into water purification measures. The paper has shown that the discounted benefits amount to almost 26 million Euros. This sum significantly exceeds the investment cost of coal filters in Gothenburg.

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