Summary of the case study on valuation of the forest ecosystem services

Title of the valuation study: **Travel cost and time measurement in travel cost models**
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Objectives of the study

The main objective was to demonstrate the difference between the use of perceived rather than calculated travel costs in travel cost models. Therefore, the authors offered a detailed description of the appraisal of travel times and costs, explaining the structure of perceived travel costs. Thus, the effect of the specification of the travel cost and time variables could be examined. A further focus point of the study was to analyse the sensitivity of the consumer surplus and price elasticity of the demand function.

Scope of the study

The ecosystem services valuated in the study were habitat services (biodiversity) and cultural services (recreation, scenic beauty). The geographical scope covered was local.

The forest recreation site under the study was located close to the major population centres of Brussels and Leuven, Belgium. "Heverleebos-Meerdaalwoud" is the second largest public forest complex in Flanders. 75% of forest visitors come from within 15 km.

Valuation method(s) applied

The data used in this travel cost estimation came from two different sources: an **on-site survey** of visitors and **GIS-computations**.

The on-site survey was used to obtain the origin and frequency of the visits as well as the visitors' perceived travel costs (n=530). For this purpose, the questionnaire was divided into four parts and contained questions on the current visit, the respondents' general recreation behaviour, respondents' attitudes towards several social and environmental issues and important socio-economic characteristics. The determinants of the perceived costs were calculated by **simple regressions**.

The **GIS-information** was used to compute travel distances and travel times to obtain calculated travel costs. Travel distances and times were rated down to the street level (eight different road types) and two calculated variable car cost concepts (pure fuel costs/car usage costs). Values of travel time-savings were based on the **concept developed by the Hague Consulting Group**, which incorporates both revealed and stated preference data. Afterwards, the **total calculated costs** were computed by summing up fuel costs and the monetary value of travel time.

For comparing perceived with calculated travel costs, only observations of respondents who came by car and who had an idea about the costs related to the trip to the forest were considered. Moreover, the **non-parametric Mann-Whitney** and **Kruskall-Wallis tests** were used to describe the difference between calculated and perceived time.

For the detection of the demand curves, the authors used a **semi-log demand function**. Thus, for each of the five different specifications of the travel cost variable, **a semi-log, negative binomial** and **truncated negative binomial model** were estimated.

The specification of the recreation demand function explained the visit frequency as a function of travel costs (monetary and time costs). It was estimated by five different recreation demand functions. The recreation demand function was estimated using the **negative binomial count data model**, which was estimated via **maximum likelihood techniques**.

Key results

- A significant difference between perceived and calculated time measures was detected. The relative difference between perceived and calculated costs is negatively related to distance and visit frequency.

- The consumer surplus (CS) per person per trip and the travel cost elasticity estimates based on the recreation demand models with total calculated costs and perceived costs was shown in Table 1 (75% of forest visitors come from within 15 km). There was no significant difference in overall performance of the five trip demand equations with the different cost specifications

Table 1 Consumer surplus and elasticity estimates

	Consumer Surplus (EURO)			Elasticity		
	Perceived costs	Total calc. costs (a)	Total calc. costs (b)	Perceived costs	Total calc. costs (a)	Total calc. costs (b)
Semi-log	4.709	6.799	/	-0.130	-0.425	0.000
Negative Binomial	4.782	4.566	14.649	-0.128	-0.632	-0.454
Truncated Negative Binomial	3.856	3.302	9.828	-0.159	-0.875	-0.677

- The comparison between perceived costs and calculated fuel costs was shown in Table 2. Average perceived costs were 4 € whereas average fuel costs and total calculated costs were much lower. Hence, perceived costs seemed to be closer to total calculated costs than to just fuel costs. Distance, perceived time and group size explained 53% of variation in the perceived costs.

Table 2 Descriptive statistics for some important variables

	Mean	S.e. mean	Min.	Median	Max.
Perceived time[1]	20.21	1.80	1.00	15.00	70.00
Calculated time[1]	15.39	1.55	0.95	12.17	59.28
Perceived costs[2]	4.08	0.40	0.00	3.12	9.92
Fuel costs[2]	0.61	0.08	0.01	0.40	3.93
Total car usage costs[2]	4.38	0.54	0.09	2.89	26.17
Total calculated costs: Fuel costs + time costs[2]	2.89	0.28	0.23	2.25	10.55
Total calculated costs: total car usage costs + time costs[2]	6.65	0.72	0.37	4.53	31.69
Fuel cost difference	11.96	2.69	-1.00	6.00	186.78
Total car usage cost difference	0.83	0.35	-1.00	0.05	23.22
Total calculated cost (a) difference	1.27	0.34	-1.00	0.36	17.72
Total calculated cost (b) difference	0.03	0.17	-1.00	-0.39	10.79
Time difference	1.40	0.30	-0.97	0.30	11.59

[1]one way, in minutes
[2]two way, in EURO

- The authors recommended the use of just one combined travel cost variable instead of two separate variables for distance-related costs and travel time.