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VALUE OF FOREST RECREATION. META-ANALYSES OF THE EUROPEAN VALUATION STUDIES

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WARTOŚĆ REKREACJI LEŚNEJ. META-ANALIZA WYCEN, PRZEPROWADZONYCH W EUROPIE

STRESZCZENIE: Celem badania było oszacowanie zmiennych wpływających na korzyści rekreacyjne generowane przez ekosystemy leśne Europy. W tym celu zgromadzono badania rekreacyjne przeprowadzone w krajach europejskich w latach 1970-2012. Zgromadzona baza danych zawiera zarówno badania preferencji ujawnionych, jak i preferencji deklarowanych. Łącznie zgromadzono 53 badania, z ośmiu krajów, które zawierają 252 indywidualnych oszacowań. Badania zostały przeprowadzone na terenie 73 różnych kompleksów leśnych na łącznej próbie ponad 40 000 osób. Dokonano tak zwanej metaanalizy, w której zmienną zależną jest gotowość do płacenia (WTP) lub nadwyżka konsumenta na osobę (CS). W badaniu podjęto próbę wyjaśnienia zmienności w WTP (CS) za pomocą zmiennych metodologicznych charakteryzujących badanie oraz charakterystyk badanych obiektów – w tym przypadku charakterystyk odwiedzanych lasów. Przeprowadzona analiza wskazuje, że ceteris paribus lasy, położone na terenie parków narodowych, dostarczają wyższych korzyści rekreacyjnych, a badania przeprowadzone w późniejszym latach związane są z wyższym poziomem nadwyżki konsumenta. Wynik ten może wskazywać, że preferencje konsumentów zmieniają się w czasie i ludzie osiągają coraz to wyższe (w ujęciu realnym) korzyści rekreacyjne z tytułu wizyt w lesie.

SŁOWA KLUCZOWE: rekreacja leśna, metaanaliza, gotowość do płacenia, nadwyżka konsumenta, obszary chronione

Introduction

The overwhelming majority of the primary valuation studies of ecosystem services conducted in the world recently were site-specific case studies, which means that their results are highly dependent on the particular site characteristics. However, generalisation of natural values and detection of tendencies in their shaping remain considerable challenges because of high heterogeneity of sites' natural characteristics. The meta-analytic approach in valuation allows for both syntheses of the values retrieved by the primary studies under consideration, and revealing the pattern in valuation methodology analysed. Meta-analyses approach allows basing study findings upon the considerable data since the number of primary studies, which it relies on, is multiplied by the number of individual observations they contain. Meta-analytic approach implies estimation of the regression model, where the target dependant variable is explained through the set of variables which account for both 'real life' characteristics (e.g. site-specific natural and socioeconomic features) as well as the strictly methodological factors, and performs estimation of their effects. As compared with the primary valuation exercises, meta-analytic studies are considerably less expensive since they do not require direct fieldwork. Besides, meta-analyses is often used as an approach which allows for the relatively more correct transfer[1] of environmental benefits estimated through the direct valuation studies into different context (benefit transfer aspect of meta-analyses is not addressed in this paper).

Therefore a considerable meta-analytical literature has emerged within the domain of ecosystem services valuation. Thus, meta-analytical valuation studies have recently been conducted for the recreational fishing resources (Johnston i in., 2006)[2]; various forest ecosystem services, assessed through contingent valuation (CVM) studies[3]; wetlands (Brander et al., 2006[4]; Kuik et al., 2009); coral reefs (Brander et al., 2007)[5].

However, in accordance with our best knowledge, only one meta-analysis of forest recreation values in Europe has been performed so far. Zandersen & Tol[3] carried out a meta-analysis based on studies that have applied the travel cost method (TCM): twenty six primary studies in total, conducted in nine European countries; they managed to include 251 independent entries into the modelling. In their analysis most of the variables describing methods used in the primary studies turned out not to be statistically significant. Besides, no natural charac-

[1] O. Kuik et al., *The value of wetland ecosystem services in Europe. An application of GIS and Meta-Analysis for value transfer*, in: 17th Annual Conference of the European Association of Environmental and Resource Economists (EAERE), 24-26.06.2009, Amsterdam.
[2] R. Johnston, M. Ranson, E. Besedin, E. Helm, *What determines willingness to pay per fish? A Meta-Analysis of recreational fishing values*, "Marine Resource Economics" 2006 no. 21, p. 1-32.
[3] M. Zandersen, R.S.J. Tol, *A meta-analysis of forest recreation values in Europe*, "Journal of Forest Economics" 2009 no. 15, p. 109-130.

teristics of the primarily valued sites (except the sites' size) proved to have significant impact on the monetary value, the result which makes the model somewhat problematic for the practical use, for instance for the benefit transfer purposes.

Shrestha & Loomis[4] performed the meta-analyses of the international outdoor recreation in the Unites States. Unlike Zandersen & Tol (2009) who concentrated on TCM primary studies only, Shrestha & Loomis (2003) included both primary studies based on revealed preferences (TCM) and stated preferences (CVM). However, since they did not restrict their study to the *forest* recreation, the two studies' results are not directly comparable. The idea of the current study was to combine the approaches of the two studies mentioned, in order to detect the impact of natural sites' characteristics on the estimated value of their recreational services.

Methodology

In our study a meta-regression technique with normalised dependant variable – a log of annual willingness-to-pay per hectare in case of CVM and annual consumer surplus per hectare in case of TCM (WTP/ha/year or CS/ha/year) has been applied. Only studies reporting CS or WTP per person per visit[5] have been used. Normalised welfare measures were obtained by multiplying WTP or CS per person per visit by total annual number of visitors and divided by area of a given site.

Since the main purpose of this meta-regression was to evaluate the impact of the site characteristics on value of the forest recreation, increasing the number of sites by pooling observations from revealed preference (RP) and stated preference (SP) studies has been expected to increase the robustness of the estimates of forest site characteristics[6]. Whilst the RP studies rely on information characterising real transactions performed by economic agents on the existing markets, SP studies derive information from purely hypothetical markets' modelling. Using estimates from SP and RP studies in one meta-regression raises concern about inconsistencies between Marshallian and Hicksian welfare measures[7]. This is because WTP estimates are derived from a Hicksian demand function, while the CS estimates are derived from a Marshallian demand function. These conceptual differences between WTP and CS are accounted for by including a method dummy variable into the regression. Some authors have applied this approach in previous studies (e.g. Shrestha & Loomis 2003).

[4] R.K. Shrestha, J.B. Loomis, *Meta-analytic benefit transfer of outdoor recreation economic values. Testing out-of-sample convergent validity*, "Environmental&Resource Economics" 2003 no. 25, p. 79-100.

[5] If CS or WTP per group was calculated, this observation was included only if information on average group size was reported.

[6] Pooling SP and RP studies provided information on 82 different forests sites.

[7] W.M. Hanemann, *Willingness to pay and willingness to accept. How much can they differ*, "The American Economic Review" 1991 no. 81(3), p. 635-647.

Valuation studies often test several model specifications and report more than just one result of interest for the meta-analysis. In most cases multiple observations from one study were included in the meta-regression by adding methodological variables that enabled differentiation between them. However, even when all differences in specifications are accounted for, the observations within the same study are likely to share some non-observable factors what in turn may result in correlated errors and biased parameters estimations.

To account for this possibility the following specification of the meta-regression model has been assumed:

$$\text{Ln}\,[\text{WTP(CS)}_{\text{ha/year}}(EUR'2005)] = \alpha + \beta x_i + \mu_i + e_{it} \quad (1)$$

Where: $\text{WTP(CS)}_{\text{ha/year}}$[8] is vector of standardized values (in 2005 EUR) from study i, x_i is a set of explanatory variables including study methodological descriptors and site characteristics. Error term is decomposed into two parts: error at the study level μ_i and e_{it} as an error at the estimation level. Both are assumed to be normally distributed with zero mean and variances respectively: σ_μ and σ_e.

A random or fixed effect specification can be used to address the issue of common μ_i across multiple observations in the same study. In case of this dataset, testing allowed us to reject random effects in favour of a fixed effect specification, which in turn was rejected in favour of equal effects specification. As a result, a classical ordinary least square (OLS) technique was employed to estimate meta-regression model.

Variables, used in the modelling qualify to one of the three following groups:

- method variables which describe the techniques used in the primary study;
- site variables which address natural sites' characteristics;
- other variables (e.g. year of data collection).

The main source of the data was a database prepared within the framework of the EXIOPOL research project. Data on GDP and population density were obtained from EUROSTAT. Variables included in the final meta-regression are listed in Table 1.

Final dataset consisted of fifty-three primary valuation studies of forest recreation conducted in between 1970 and 2012 in eight countries plus Northern Ireland, which gave 253 entries into the model; seventy-three forest sites have been included into the modelling. Primary studies included into dataset contain the records of over 40 000 of individual observations. For the full bibliography of the primary studies included into dataset, please see Giergiczny, Mavsar and Zhou[9].

[8] Henceforth WTP will be used in the text, however whenever it is used it may denote also CS.

[9] M. Giergiczny, R. Mavsar, W. Zhou, *Report documenting the results of the meta-data analysis linking the monetary values with the physical characteristics of forests,* EXIOPOL Report Series, Milano 2008; www.feem-project.net [20-09-2014].

Table 1
Variables included in the meta-regression model

RP	1 – if Revealed Preference method (Marshallian measure) 0 – if Stated Preference method (Hicksian measure)
DC	1 – if dichotomous choice elicitation format in SP 0 – otherwise.
OE	1 – if Open ended elicitation format in SP 0 – otherwise.
OValue	1 – if option value included, 0-otherwise
Ttime	1 – if value of time is accounted for, 0-otherwise.
ML	1 – if ML estimator was used in RP method, 0-otherwise.
	SITE VARIABLES
	Nine country dummies (8 countries plus Northern Ireland) with Great Britain as reference level
Ln_Inc	Log of Income on country level (EUR '2000)
Alt	Elevation of the highest point in the forest area (in hundreds of meters)
Ln_Size	Log of study site forest area (ha)
Protected	Protection status 1 – if protected in the form of national park, reserve or natural park, 0 – otherwise
Ln_Density	Log of Population density (NUTS 3 level) (people/km^2)
	OTHER VARIABLES
Year	Year of data collection

Source: own elaboration.

Results and discussion

The meta-regression results are presented in Table 2. Since a part of variables enter a model in linear whilst the others in log-linear way, direct comparison of their impact is rather difficult, however they still allow for economic interpretation.

The signs and significance of the variables are in most cases consistent with a priori expectations and past recreation valuation studies. One serious exception is GDP per capita, a variable used as a proxy of income level. Basically, income is expected to have positive effect on WTP, however in this study coefficient by logarithm of income GDP per capita (PPP) has been found to be negative and not significant. A similar result was found in Zandersen & Tol (2009).

Dummy variable 'RP' is positive and highly significant, indicating that contingent valuation method (CVM) studies produce lower estimates of WTP than do

Table 2
Regression results

SYMBOL	Coefficient	Standard errors
METHOD VARIABLES		
RP	1.959***	.425
DC	1.837***	.462
OE	1.306***	.459
OValue	0.643	.430
Ttime	0.435*	.261
ML	-0.421	.456
SITE VARIABLES		
Ln_Alt	0.131*	.079
Ln_Size	-0.451***	.069
Protected	1.06***	.2205
Ln_Density	0.686***	.104
Ln_GDPPPP	-0.054	.716
Year	0 .0531*	.0284
COUNTRY DUMMIES		
Austria	2.701***	.766
Germany	2.215***	.592
Ireland	2.483***	.632
Italy	0.435	.366
Northern Ireland	1.062*	.599
Poland	1.701	1.102
Spain	1.887***	.527
R^2=0,61; N obs.=253, Indicates statistical significance at: *** 0.01 level, * 0.1 level		

Source: own elaboration.

travel cost method studies (TCM), a result consistent with Carson et al.[10], Walsh et al.[11] and Shrestha & Loomis (2003).

Unlike in Zandersen & Tol (2009) the following site characteristics: altitude, forest area, protected area, density of population proved to be statistically signif-

[10] R.T. Carson, N.E. Flores, K.M. Martin, J.L.Wright, *Contingent valuation and revealed preference methodologies. Comparing the estimates for quasi-public goods*, "Land Economics" 1996 no. 1(72), p. 80-99.

[11] R.G. Walsh, D.M. Johnson, J.R. McKean, *Issues in nonmarket valuation and policy application. A retrospective glance*, "Western Journal of Agricultural Economics" 1989 no. 14, p. 78-188; R.G. Walsh, D.M. Johnson, J.R. McKean, *Benefit transfer of outdoor recreation demand studies: 1968-1988*, "Water Resources Research" 1992 no. 28, p. 707-713.

icant. Since dependant variable was log of WTP/ha/year the coefficients by variables that are logarithmically transformed are estimates of the elasticities.

While the model, presented in the Table 2 exhibits the best fit, different specifications of meta-regression function were also tested. For example when altitude was employed into the regression in a linear form, its coefficient was highly significant at 0,01 level. Estimated coefficient 0,073 indicated that an increase in elevation by 100 meters raised WTP/ha/year by 7,3%[12]. The question however arises: do people prefer to visit forests that are situated in highlands or mountains or they just like highlands or mountains and detected positive impact on their WTP has nothing to do with presence of forest? Given the current dataset this question is rather difficult to answer, however there are reasons to believe that people indeed may derive bigger recreational benefits from forests situated in the highlands or mountains comparing to forests in lowland areas[13]. Therefore this variable could have also been employed into a value transfer function.

Another interesting result is coefficient by variable 'Protected', which indicates that if forest is legally protected then WTP/ha/year is higher by 106% as compared with the forests which are not. Assuming that protection status is an indicator of relative uniqueness of a given ecosystem, obtained results indicate that standardised recreational benefits are higher for forests in which the natural processes are relatively better preserved.

Positive and highly significant coefficient at country dummies for Austria, Germany, Spain or Ireland would have indicated higher conservational values of continental and Irish forests as compared with the same of British ones. However, this difference can be more realistically explained by the relatively more numerous valuation studies, conducted in the Great Britain as compared with the other countries and territories under consideration. There studies cover the majority of country's woodland whilst less numerous valuation studies conducted in other countries may focus on the most valuable sites in the first turn. Similarly, not significant coefficient in case of Poland may be interpreted as a result of relatively not numerous primary valuation studies conducted in the country.

Conclusions

Method variables effects are consistent with the literature (e.g. Carson *et al.* (1996), Shrestha&Loomis (2003): *ceteris paribus* SP studies provide lower estimates then RP ones.

The following site characteristics have produced significant results in terms of the effect on the normalised WTP per year per ha for the forest recreation: sites' altitude, forest area, protected area status, density of population have

[12] In fact what people may care more about is the difference in level between the highest and lowest part. However data on highest point are much easier to encounter and these variables are likely to be highly correlated.

[13] Mostly landscape amenities but also some recreational activities like: hiking, mountain biking.

proved to be statistically significant (interpreted as elasticity because of logarithm in the left-hand side of the model) – unlike in Zandersen & Tol (2009) except the size – however some of them are missing undivided interpretation (e.g. altitude). Income – GDP per capita (PPP) – turned out to be not significant (the same found by Zandersen & Tol (2009).

Possibly, the most important finding of the study, is that the protected area status turned out to be positive and highly significant. Assuming that protection is an indicator of relative uniqueness of a given ecosystem, obtained results indicate that standardised recreational benefits are higher for forests in which the natural processes are relatively better preserved. This finding can be considered the study's added value, since the past studies failed to produce similar result, the one which may have considerable political importance.

Ceteris paribus the more recent valuation studies retrieve the higher level of consumer surplus (either Marshallian or Hicksian). Consumers' preferences might have changed in time yielding ever higher recreational benefits, derived out of forest recreation.