

XI ECOECO

VII Congreso Iberoamericano
Desarrollo y Ambiente

XI ENCONTRO NACIONAL DA ECOECO
Araraquara-SP - Brasil

META-ANALYSIS FOR BENEFIT TRANSFER OF RECREATION VALUES IN BRAZIL

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Abstract:

In Brazil, recreation services have gained importance to the economy over the last twenty years. Recreation values have been increasingly estimated since 1990s, but the estimated values have shown high variability. This study aims to shed some light on the factors affecting the average willingness to pay for recreation in Brazil using meta-regression models. The analysis is based on a sample of 37 recreational studies, spanning the last 18 years, from which 70 average willingness to pay estimates were extracted. Double-log meta-regression models are fitted for the pooled travel cost demand and contingent valuation data sets in order to test the significance of each group of variables in explaining the heterogeneity in mean willingness to pay. Convergent in-sample validity tests based on the regression model show that the mean benefit transfer error was around 51%, slightly lower than is typical in the benefit transfer literature.

Key-words: Meta-analysis, recreation. value transfer, Brazil.

1. Introduction

This study aims to conduct a meta-analysis of the recreation values relying exclusively on original studies conducted in Brazil. Thus, the research objective is to explain the variability of the mean willingness to pay using meta-analysis models. In addition, a benefit transfer function is fitted and the predicted values for study sites are estimated and tested for validity. We are unaware of any meta-analysis previously done to analyze the recreation values in Brazil.

Meta-analysis is a methodology that summarizes or synthesizes outcomes reported in several studies using multivariate regression analysis (Bergstrom and Taylor, 2006). Traditionally, meta-analysis has been applied to provide statistical summaries of past research and explain the variation in the dependent variable across studies. Recently, meta-analysis has been pursued as an alternative approach to estimate value transfer function enabling the benefit transfer. Benefit transfer is a practical method used to adapt information and data derived from an original research and transfer them to a new context which has little or no data available.

2. Meta-Regression Models and Data

The dependent variable is a welfare measure specified in terms of mean or median willingness to pay for a marginal change in the recreational site quality. Constrained by the

data availability, the independent variables included in the meta-regression models were classified into three categories: (i) characteristics of the recreation sites (X_{si}); (ii) characteristics of the study publication (X_{pi}); and (iii) features of the survey design and valuation methods (X_{mi}). The omitted variables are captured by the error terms e_i . The empirical model can be expressed as:

$$WTP_i = \beta_0 + \beta_s X_{si} + \beta_p X_{pi} + \beta_m X_{mi} + e_i \quad (1)$$

The tested functional forms were linear, semi-log (lin-log or log-lin) and double-log functions. Models with dependent variables having the same format (level or log format) were tested comparing the adjusted R^2 results. Models with different dependent variable formats (level or logarithmic) were tested by the Box-Cox test. The test results showed that the double-log is the best functional form fitting the pooled data.

The empirical strategy for the meta-analysis consisted of estimating five meta-regressions models. The first one is the fully specified meta-regression model using the pooled travel cost demand model and contingent valuation data sets which is used to investigate the systematic effects of the explanatory variables on the mean welfare measures. Three meta-regressions models are estimated by dropping out one variable group at a time and assessing the variables' significance and explanatory power of each variable group. The fifth meta-regression model – the benefit transfer function (BTF) – is estimated by the leave-one-out cross validation approach (LOOCV).

The data base is formed by information extracted from the primary valuation studies that have estimated welfare measures for recreation services in Brazil. Thirty seven primary studies were selected from which seventy welfare measures were drawn to form the dataset of recreation values. The year of the selected studies ranged from 1994 to 2012, that is, spanning 18 years.

3. Results and Discussion

Among the MRM estimated with the pooled SP and RP data sets, Model 5 was the best model showing the highest adjusted R^2 (0.565). The second best model was the fully specified model (Model 1) with a slightly lower adjusted R^2 (0.535). The former model was estimated with a smaller number of predictors what could have contributed to reduce the multicollinearity problem faced by the latter model.

The convergent validity based on percentage difference (CVT_{PD}) was estimated in plus/minus 51.4%. The Mean Comparison t-test shows that the sample means of the actual values (3.705) and predicted values (3.714) are not statistically different at 1% level. The Pearson's correlation measures show that the actual values and predicted values are highly correlated and the correlation coefficient is statistically different from zero at the 1% level.

4. Conclusions

The results confirm previous studies that average of the mean willingness to pay for recreation is affected by the some variables describing the characteristics of the study context, nature of the recreation environment, and survey and valuation methods. The convergent validity tests for the benefit transfer of recreation values showed high degree of convergent validity, somewhat better than other benefit function transfers in other

countries such as the USA. In particular the meta-analysis benefit transfer within sample error was around plus/minus 51%.

References

Bergstrom, J. C., Taylor, L. O., 2006. Using meta-analysis for benefit transfer: theory and practice. *Ecological Economics* 60, 351-360.