DISSERTATION

ECONOMIC VALUE OF RECREATIONAL RESOURCES: TESTING BENEFIT TRANSFER APPROACHES

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY RAM KRISHNA SHRESTHA ENTITLED "ECONOMIC VALUE OF RECREATIONAL RESOURCES: TESTING BENEFIT TRANSFER APPROACHES" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

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There have been various efforts recently to transfer the economic values of recreational resources from one site to another in the United States. In the case of typical non-market goods, the benefit transfer approach has been as useful as the standard non-market valuation techniques, such as, contingent valuation method (CVM) and travel cost methods (TCM), in recreation decision making. The most attractive feature of benefit transfer, instead of conducting primary research on non-market valuation, is the use of existing findings and attributes of the primary research. Obviously, benefit transfer could save significant amount of time and resources, if it is practiced in real world policy decisions. However, for the benefit transfer approach to be more useful, it has to demonstrate its scientific basis, theoretical consistency and methodological validity. The main objective of this study is to demonstrate the application of meta-analysis in taking the stock of information, knowledge, and methodological developments in economic valuation of recreational resources and use those results to real world benefit transfer.

To this end, the existing CVM and TCM studies of the United States and Canada on outdoor recreation were gathered, and the meta-analyses were performed on the

variables obtained from those studies. Since no so called panel effect was found in the datasets, classical liner regression models were estimated.

The application of meta-regression models in benefit transfer were further tested and analyzed in terms of out of sample convergent validity confirmation. In this testing procedure the new studies from the United States, not included in the meta-regression models estimated previously, were used. Similar testing and analyses were also performed using international out of sample studies in order to evaluate the application of meta-analysis in international benefit transfer process. The paired t-test revealed that there was no convergence between the means of meta-regression models predicted WTP values and the original out of sample studies WTP values within the United States. However, significant convergence between those values in the international context was revealed. Interestingly, there were significant positive correlations between those values in both national and international cases.

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Finally, I am thankful to my mother, wife, sisters and daughter for their patience and sacrifice to let me accomplish this enriching goal.

DEDICATION

This work is dedicated to the loving memory of late Prem B. Shrestha, my grandfather and late Indu R. Shrestha, my father.

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PART I

INTRODUCTION

Part I of this dissertation introduces the subject, benefit transfer of recreational economic values through meta-analysis. This contains Chapter 1, where an overview of the nature of recreational resources and economic rationale of their efficient allocation is provided in section one. This section also introduces the application of benefit transfer through meta-analysis, a method in obtaining the non-market value of recreational resources. Further discussions proceed with the details on problem statements, the conceptual framework in a schematic diagram, and the outlines of the importance, objectives and limitations of the study. The final section gives an overview of the remaining chapters of the dissertation.

CHAPTER 1

Benefit Transfer of Recreational Economic Values with Meta-Analysis

1.1. Introduction

Recreational resources have been increasingly important in recent years as the escalating demand of those resources has resulted in competition among the different uses of natural resources, and the management of the resources has come under increasing government scrutiny. Recreational resources are the goods and services provided by nature including land, water, forest and biodiversity, which support outdoor recreation activities at a particular site. Activities such as camping, hiking, biking, viewing, fishing, just to name few, occur in different natural areas and resources. From an economic standpoint, the most important aspect of recreational resources is their allocation across different competitive uses. An efficient allocation of any resource ensures its optimal use towards maximizing total social welfare (Randall, 1987). However, efficiency in resource allocation is contingent upon its physical attributes and the market structure at large.

Due to the public good nature of many recreational resources and activities the efficiency in their market allocation is often questionable. In most cases dispersed outdoor recreation is public good, i.e., non-excludable and non-rival in use. This basically means that someone's hiking in an uncongested area, should not reduce someone else's pleasure in viewing the same scenery. Furthermore, the values of recreational resources are not fully reflected in the market. This is simply because those values are external to their market price since the resources provide more real value, e.g., consumer surplus (CS), than market price accounts for. Thus, the market fails to efficiently allocate recreational resources because of their public good characteristics and associated external benefits.

The government agency has, therefore, a responsibility to provide recreational resources that requires some criteria to efficiently allocate funding and other resources. Benefit-cost analysis (BCA) has been one of the basic criteria in this process with the view that the allocation of the resources in a particular use should ensure that the benefits outweigh the costs in the society at large. However, BCA on recreational resources has been largely constrained by their non-market attributes and values. There has been a significant progress in the economic valuation, process and methods, of non-market goods and services, but everyday policy decisions of public agencies in managing recreational resources are highly limited by timely access to such information. The time and resource constraints of these agencies to conduct primary studies on economic valuation call for the need of benefit transfer in recreation economic decisions (Desvousges et al., 1998, Smith, 1992, McConnell, 1992, and O'Doherty, 1995).

The benefit transfer is typically an approach where one essentially uses the numeric value of the non-market goods derived from one setting and applies or adapts them to another setting. This term in economics literature was used initially as an alternative to a full-scale assessment of economic values (Smith & Desvousges, 1986 in Desvousges et al., 1998). In the current literature the use of existing studies to value recreational resources of new sites is referred as "benefit transfer"; the place where the study is conducted as "study site"; and the location where the benefit of improvement is measured as "policy site" (Desvousges et al., 1992). Thus, the benefit of a non-market good is essentially derived from a study site(s) and transferred to the policy site for relevant analysis. This is an application of secondary data to a new policy purpose. Similar interpretation may apply in any other information transfer, but we exclusively focus on "benefit transfer" in this study. In general when we refer to the benefit transfer in the natural resource valuation, it means developing numeric values from a set of models using data of the study site and applying them to the resource valuation in the policy site (McConnell, 1992). Obviously, there can be a wide range of such numeric values and the valuation criteria to be considered, where researchers' ultimate judgment would be much more important.

Various approaches of benefit transfer have been practiced in recreational resource planning and management in the United States. The use of unit day value transfer was developed by United States Water Resouces Council and the United States Department of Agriculture (USDA) Forest Service (Loomis & Walsh, 1997, U.S. Water Resource Council, 1973, 1979, 1983). More recently, the direct transfer approach, benefit transfer from the selection of a best-matched study; and the benefit function transfer, which accounts for the differences in site characteristics and demographics are of frequent uses. Moreover, the development of meta-analysis in this field, an econometric method of synthesizing existing studies for benefit transfer, is one of the latest applications.

Meta-analysis application in recreation economics is to understand the influence of different methodological and study specific factors on the outcome of the study. The first two meta-analyses by Walsh et al. (1989, 1992) and Smith and Kaoru (1990) sought to explain the variation in consumer surplus per day estimated from contingent valuation and travel cost methods. More recent applications of meta-analysis in economics include: groundwater valuation (Boyle, et al., 1994), air quality valuation (Smith and Huang, 1995), endangered species valuation (Loomis and White, 1996), air pollution and visibility effects (Smith and Osborne, 1996), price elasticity of water (Epsey et al., 1997), health effects of air pollution (Desvousges et al., 1998), recreational fishing (Sturtevant et al., 1998), transfer of tourism multiplier (Baaijens et al., 1998), wetland valuation (Brouwer et al., 1999), and price elasticity of public transportation across countries (Nijkamp et al., 1999).

A recent use of meta-analysis has been to more systematically utilize the existing literature for the purpose of benefit transfer. Essentially, the meta-regression equation coefficients estimated using available studies can be used to estimate benefits of the studies of a unstudied policy site. The recent study by Loomis et al. (1999) concluded that rather than using an average of a few point estimates from past studies, the meta-equation has at least three advantages. First, it utilizes information from a greater number of studies providing more rigorous measures of central tendency sensitive to the underlying distribution of the study values. Second, methodological differences can be controlled for when calculating a value from the meta-analysis equation. Third, by setting the level of the independent variables specific to the policy site, the analyst can potentially account for differences between the study site and the policy site. Thus benefit transfer using a meta-analysis equation shares some of the potential advantages of benefit function transfer espoused by Loomis (1992).

The main purpose of this dissertation is to contribute to the refinement and testing of meta-analysis as a benefit transfer tool. To do this, first, the meta-analysis of Walsh et al. (1988, 1989, 1992) is updated with additional studies and investigated the empirical importance of the panel nature of the reported study values. Second, the relative accuracy of the meta-analysis derived estimated benefit is evaluated by performing an out of sample test. Finally, the meta-analysis methodology is extended to international benefit transfer applications to address the growing demand for recreation resources valuation in other countries.

1.2. Problem Identification

1.2.1. Value of Recreational Resource

Most recreational resources are characterized as non-market goods. The public good attributes of the resources and the associated externalities hinder markets to efficiently allocate these resources. Thus, non-market valuation techniques are the necessary tools to identify the value of recreational resources. The increasing use of valuation methods to estimate the value of those resources is a logical extension of the economics of resource allocation (McConnell, 1992). Furthermore, efficiency in allocation of any resource will be achieved when the marginal cost of the allocation equals its price. Prices reflect values that come from consumers' willingness to pay (WTP) or consumer surplus (CS). Thus, economic efficiency criterion calls for the appropriate valuation of resources, which determines the allocative decision made in the private as well as in the public arena. Allocative decisions in the public sector can be broadly based in the notion that the decision will benefit at least as much as its potential cost (Randall, 1987). This raises the issue of requiring benefit cost analysis in every outdoor recreation decision made by the government agencies, where the economic value of resources becomes crucial (Sassone & Scheffer, 1978).

1.2.2. Benefit-Cost Analysis Framework

Benefit cost analysis (BCA) has been one of the major economic tools in public policy evaluation and decision making since 1938 when United States Congress made it a required criterion for water resources development decisions. The use of BCA has been further emphasized in Federal policy decisions in 1981 under President Reagan's Executive Order 12291 (Smith, 1984). However, the tool has been used widely in many countries and in different agencies regardless of their public, private profit-seeking or non-for-profit character. BCA practices in international agencies, such as, the World Bank and the Organization for Economic Cooperation and Development (OECD), greatly influenced the development of the method and experience (Desvousges et al., 1998). However, the standard BCA would be applicable in recreational economic decisions quite well.

1.2.3. Non-Market Values

While considering economic values of recreational resources we tend to focus on use values, whereas the total economic value includes virtually all non-market values including non-use values (bequest, option and existence values) as well.

Non-market valuation techniques of valuing natural resources have been widely debated in the economic literature. However, it has paved its path reasonably well with innovation, modification and improvement in approaches as well as in the methodologies.

Currently, one can easily find a series of non-market valuation studies beyond recreation, but outdoor recreation may be one of the most prolific areas in which non-market valuation studies have been published. The important question then becomes whether that is enough. Obviously, the answer is, no. This is mainly because each outdoor recreation area has some unique features such that every other decision based on non-market valuation may require a separate study with the estimates of the people's willingness to pay, their socioeconomic characteristics and site attributes. Therefore, it is often referred that each recreational decision may warrant separate study to identify the original value of the resource. These studies often take months to complete and cost hundreds of thousands of dollars. Clearly, this is not a feasible thing to do in many public policy decisions. As a result the concept and practice of benefit transfer has emerged.

1.2.4. Benefit Transfer Approach

The transfer approach in general and benefit transfer in particular is introduced according to the need for benefit estimates of non-market resources, and time and resource constraints in obtaining those empirical estimates. The policy decisions regarding recreational resources often require benefit values, but in most cases those values are not readily available or may be even outdated. Thus, the public agency in such a context will either have to conduct primary research or transfer benefits from existing studies. Transferring benefit estimates out of existing studies would have been the immediate choice had there been no other issue associated with benefit transfer approach itself. The basic issues in benefit transfer in recreation have been on the reliability of the primary estimates as well as the other potential biases in the transfer process (Brookshire

& Neill, 1992). There has been significant developments in the theory and technique of economic valuation in recreation, particularly, the contingent valuation (CVM) and travel costs (TCM) methods. This largely contributes in finding primary estimates of non-market values, which will not be discussed more in this research. But, the concern here is mainly on the second issue, i.e., dealing with the problems in benefit transfer. A schematic framework of the benefit transfer with meta-analysis is presented in Figure 1.1.

Although there may be various applications of data transfer in planning process, the concept of benefit transfer is relatively new. It has important application in natural as well as social sciences. More recently, the benefit transfer approach is emphasized in recreation decisions in the USDA Forest Service in the United States (Loomis & Walsh, 1997). However, the application is more of a challenge with respect to the growing development in the transfer approaches, benefit estimation techniques and revision in the values of the resources.

Benefit transfer approach in recreation is categorized as the transfer of unit day value, direct benefit transfer, benefit function transfer, and meta-analysis and transfer. The unit day value estimate is a point estimate measured in terms of the value per person per day for any outdoor recreation activity. This was first introduced in 1962 by U. S. Water Resource Council, then in 1980 USDA Forest Service in conjunction with its Resource Planning Act of 1974 (RPA) and periodically updated on every five years (Loomis & Walsh, 1997, Walsh et al, 1992). These values were initially developed based on the existing studies and experiences. However, the updated RPA unit day values of 1985, 1990 and 1995 were based on the development in the existing literature and estimation process.

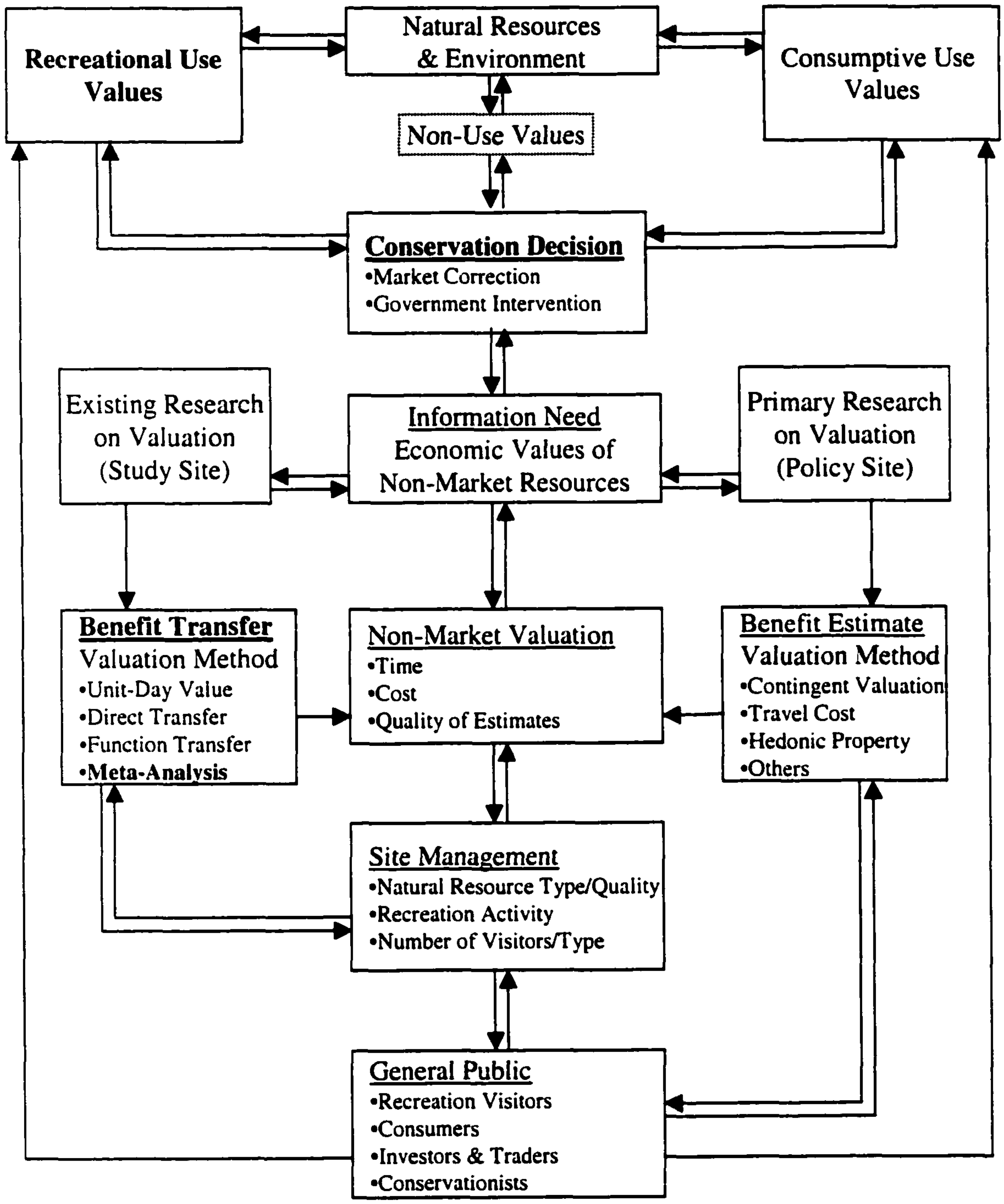

Figure 1.1: Conceptual Framework of Recreational Resource Valuation and Benefit Transfer.

Direct benefit transfer is also referred as the direct transfer or basic transfer, which is mainly the transfer of value(s) estimated from so called "best" study or studies to the relevant policy site (Sturtevant et al., 1998). Direct transfer usually tries to come up with the study and the estimates that best reflect the attributes of the policy site. But, in many cases, it is difficult to have the study or estimates that could be directly transferred to a new policy site since each site may have some distinct features to be accounted for in the economic valuation (Luken et al., 1992, Boyle & Bergstrom, 1992).

To the extent benefit function transfer approach has some useful features since in this approach analyst basically transfers entire demand function from a study site to the policy site. In so doing the benefit estimates could be adjusted to the site characteristics and demographics. However, most validity tests performed with regard to the benefit function transfer have failed to demonstrate the transferability of the benefit function (Loomis, 1992, Loomis et al., 1995). Also, the benefit function transfer analysis revealed variable transfer errors. Brouwer (2000) assessed several studies to test the benefit value transfer and found the transfer errors ranged from 56% to 475%.

1.2.5. Meta-Analysis and Benefit Transfer

This brings us to the approach of meta-analysis, a more recent approach applied to benefit transfer but fully developed in education, health science and psychology in synthesizing the existing research findings. This approach has a promising feature as it accounts for the methodological effects as well as other site and demographic attributes (Walsh et al., 1992, Smith & Kaoru, 1990). In this approach, benefit values are estimated from multiple studies using regression techniques. Thus, the study site values become observations into the regression model, which will account for the site and user variables specified in the model. We will exclusively focus on meta-analysis approach to outdoor recreation benefit transfer in this research.

1.3. Importance of the Study

Benefit transfer in outdoor recreation has been useful for several reasons. Firstly, there is a significant growth in recreation activities, number of visitors and hours spent during the visit in the United States in recent years (Loomis & Walsh, 1997), which brings the issue of more demand for the recreational resources. Then, the existing allocation of the resources has to be readjusted based on the demand and associated economic values. Secondly, the agencies, that are involved in the outdoor recreation or related decision making would require more recreation sites to open, manage or improve. This, of course, requires instant information on the costs and benefits. As we discussed above, conducting primary research every time for individual decisions is not always feasible. Thus, benefit transfer would be the ultimate source of information in estimating the benefit of the policy site.

In a more general context, benefit transfer mainly originated from the requirement of BCA in government decision making due to the institutionalization of this since Executive Order 12291 in the United States. The government planner and specialists would be tempted to use benefit transfer approach since they are mostly constrained by time and resources to retrieve information, analyze them and make a decision. Moreover, conducting primary research in everyday policy process would not be efficient, and more importantly, most of them would be of limited scope, could have short time horizons, and may have funding uncertainty (Boyle & Bergstrom, 1992). In that case benefit transfer would serve as an important pool of information.

Benefit transfer is practiced in international context as well. There are some interesting examples of health benefit transfer. More often benefit transfer needs are also expressed by the international development agencies and aid organizations, such as the World Bank, the United States Agency for International Development (USAID) and many others (McConnell, 1992, Krupnick, 1993, Desvousges et al., 1998). However, the practice is infrequent and limited. Currently, there is a growing potential of benefit transfer in recreation and tourism due to the increasing number of non-market valuation studies in many developing countries.

Most importantly, meta-analysis approach has provided an important avenue of a new method for benefit transfer that enables researchers to account for the methodological and site characteristics better (Sturtevant, 1998). A major concern in past benefit transfer approaches had been the difficulty in adjusting the benefit estimates for the contextual differences between study site and the policy site. For that matter, meta-analysis has a systematic and objective mechanism to adjust original estimates to better match the policy site. Also, meta-analysis takes the stock of existing studies in the model, which then accounts for the cumulative effects of the developed methodologies and approaches in the research area over time (Bal et al., 1999). Thus, this would provide a more appropriate and synthesized result of the research in particular discipline. In case of benefit transfer in outdoor recreation, the welfare estimates obtained from meta-analysis could be more generic and transferable to a new policy site with greater reliability. Since, the meta-analysis technique, as such, is a well established method in synthesizing literature for more than a half-century, application of this method in benefit transfer provides a convenient marriage of two different fields to obtain greater insights into the problem and reliable estimates of benefits.

1.4. Objective of the Study

A broader objective of this study is to apply the meta-analysis technique in benefit transfer evaluation in recreation economic decisions. The basic meta-analysis model is built based on the data from outdoor recreation activities in the United States and performed various validity tests, and finally tested the model for international benefit transfer application. The specific objectives are outlined as follows:

i. To update the recreational economic values of the United States and develop a meta analysis model(s) for recreational benefit transfer;

ii. To identify the important characteristics (variables) which determine the economic values of recreation activities in the meta-analysis;

iii. To diagnose the model regarding differences in the influences of the variables across locations, i.e., the census regions of the United States;

iv. To analyze the external or out-of-sample validity of the meta-regression model(s) in finding the economic values of new sites and activities;

v. To evaluate the external validity of the meta-regression model for the international benefit transfer.

1.5. Limitation of the Study

This study is an effort to enrich the systematic and objective approach to benefit transfer in recreation. However, the meta-analysis may be limited by the availability of limited existing studies in many recreation activities in the United States. This constraint is even more severe in an attempt to analyze international benefit transfer.

Moreover, the analysis and the result of the study would consist of the inherent limitations of incomplete information in using secondary data, and other site differences that are not accounted for in the meta-analysis models.

1.6. Organization of the Study

The current Chapter 1 consists in Part I of the dissertation. Part II contains Chapter 2, which gives an extensive review of relevant literature in benefit transfer and meta-analysis. These two separate approaches are developed in different fields. The review of the literature on the benefit transfer is based on several articles published in scientific journals, and the books and book chapters relevant to this topic in economics or more specifically in recreation economics. However, the application of meta-analysis as quantitative technique in reviewing past research finding is reviewed from the published articles and books on the subject beyond economics. Finally, an application of meta-analysis in benefit transfer is reviewed in this chapter.

Part III provides a discussion on methodological developments, meta-analysis models and the discussion of the empirical results. Chapter 3 in Part III shows the economic framework in benefit transfer and also demonstrates the convergence of two methods- benefit transfer and meta-analysis in a schematic diagram. This chapter also discusses the several econometric modeling techniques in meta-regression model estimation and the techniques to measure the performance of the estimated meta-regression models. Moreover, a complete reference of the data sources, data collection procedures and coding are also discussed.

Chapter 4 deals with the meta-analysis results and their applications in benefit transfer. This chapter introduces with computation of the average benefit estimates for individual recreation activities, which could be transferred as the point estimates. Then, the meta-regression results and the discussions are followed. Lastly, the performance assessment of the meta-regression models as well as other existing techniques in benefit transfer is discussed. A schematic flow chart showing several steps to benefit transfer, given the information and the circumstances, is also presented as the users' guide.

The convergent validity of the meta-regression models estimated in Chapter 4 is tested in Part IV of the dissertation. Chapter 5 in Part IV analyzes and discusses on the out of sample testing. In this analysis, the new studies not included in the meta-regression model estimation are considered as out of sample estimates and treated as the original data for test purposes. Then, the meta-predicted WTP values and original values from the out of sample studies are tested to demonstrate whether they are statistically equal. Next, the similar analyses are presented in case of international benefit transfer evaluation in Chapter 6. In this chapter, the original out of sample studies on outdoor recreation are gathered from different countries around the world, and applied the same testing process as in the Chapter 5. Finally, in this Part IV, the summary and conclusions of the research, focused on the methodological contribution and empirical findings are presented.

Part V includes supporting documents and information, which were used in the entire research. This contains mainly the references sited in the study, the complete lists of references of the studies used in meta-analysis and out of sample testing, coding guides, and other relevant annexes referred in the study.

PART II

LITERATURE REVIEW

Part II of this dissertation consists of the literature review, Chapter 2. The review mainly focuses on the concept and the development of benefit transfer approaches in recreation economic valuation and the application of meta-analysis technique in benefit transfer. Since, these two methods are developed in different disciplines, the relevant literature in economics and other social sciences are reviewed and discussed. Finally, the convergence of the two approaches as a benefit transfer tool is explained.

CHAPTER 2

Review of Literature in Benefit Transfer and Meta-analysis

2.1. Introduction

The value transfer approach is an economical way to obtain and use important information in policy decisions when a full-fledged primary study is not practical or not even necessary (Desvousges et al., 1998). This approach may be commonly used in private, public or corporate planning where the numeric value derived from one context is directly applied into some other contexts. Smith (1992) refers that one of the earliest examples of benefit transfer may be the study that sought to evaluate the gains people would have realized from removing commodity-specific excise taxes in the United States. Those transfers were mainly applied in marketable commodities. Later, analyses of water related investment project in 1950s changed some of the conditions featured in those early transfers (Smith, 1992).

However, benefit transfer has been used for several years in legal proceedings and government policy analyses where the use of original benefits estimates are often constrained by time and funding (Boyle & Bergstrom, 1992). Because of limited research budget and time for preparing benefit cost analysis, Environmental Protection Agency (EPA) suggests that the benefit transfer, i.e., "off-the-shelf" methodology, where possible, should be used (Desvousges et al., 1992, Freeman, 1984).

When we consider benefit transfer in outdoor recreation, we implicitly refer to the benefit estimates in the context of non-market valuation. This is about transferring the benefit estimates derived from such a valuation process, or transferring the estimate to the site where the first hand benefit estimates of non-market goods and services are not available.

Since the benefit transfer is entirely based on the estimates from primary studies, Brookshire & Neill (1992) states that it can only be as accurate as the initial benefit estimates. Then, the question becomes how reliable are the estimates derived from the non-market valuation. While answering this question, one must consider the methodological and empirical issues associated with non-market valuation in general. There are continued debates in economic literature regarding non-market valuation methods despite significant amount of research and development in the field. But beyond the debate, Brookshire & Neill (1992) stipulate that benefit transfer is still a feasible approach mainly because of two reasons:

> Firstly, some types of benefit estimates are subject to less controversy than others; secondly, there exists a pragmatic environment surrounding policy decisions, that is, some decisions do not necessarily require the same level of accuracy (Brookshire & Neill, 1992: 652).

A somewhat different logical explanation on benefit transfer in recreational economic decision comes from the fact that researchers' judgment is a prime factor in most social research. McConnell (1992) views benefit transfer as follows:

> ... while standard hypothesis testing plays a role in model estimation, it may be less important than the researcher's judgment about how the model ought to work. The power of economics lies principally with the logic of theory, and then with the strength of empirical evidence. The implication for benefit transfer is that this is also within the realm of judgment of the

> researcher, but it will be more acceptable when judgment is recognized (McConnell, 1992: 695).

McConnell (1992) mentioned two important assumptions to be made with regard to the analysis of recreation benefit transfer, i.e., imperfect market of the goods to be valued and non-market valuation of the goods in question. These two assumptions imply that the transfer of benefits from one site or region to another can never be mechanical. According to McConnell, the study site benefits would have been modeled with a series of informed judgments of the researcher, this means that the transfer of those benefits to the policy site must involve judgment. For example,

> Although economists never observe consumer surplus, their judgment about the size of surpluses suggests that it is possible to give a reasonable ranges of surpluses (McConnell, 1992: 700).

From the above discussion it is evident that the benefit transfer process and the results are not mechanical, rather they require judgment. Thus, the issue becomes one of limits and the protocol associated with the transfers as against whether benefit transfers should be implemented at all (Brookshire & Neill, 1992). Despite the issues involved in benefit transfer the value of information in recreation economic decisions would require the method to be used, and the work of a careful researcher would enhance its reliability.

2.2. Scope and Importance

Benefit transfer has played important role in the public policy decisions, where first hand information is often unavailable. Demand for benefit transfer in the United States increased mainly since the Executive Order 12291, 1981 of President Reagan, which has formalized the use of BCA in policy decisions of the Federal Government

(Smith, 1984, Krupnick 1993, Desvousges et al., 1992). This order has a guide role in benefit transfer as Freeman (1984) outlined some model illustrations with a probabilistic decision tree. He mentioned that using off-the-shelf benefit estimation models of air and water quality with some modification would be a convenient "tactic" to obtain benefit estimates of the new regulations to comply with Executive Order 12991. Freeman showed the illustrations of benefits in having a project and costs without it, using the benefit estimates derived from existing studies and associated probabilities.

McConnell (1992) outlined two sources of demand for benefit transfer. Firstly, information needs of the regularity process are immediate, where it is frequently impossible to do a new analysis of a project at hand. This calls for transferring benefits from the existing studies. Secondly, the demand for benefit transfer comes from litigation in natural resources damage under Comprehensive Environmental Responses, Compensation and Liability Act (CERCLA) and similar cases. But, application of benefit transfer is more common due to first reason mainly because many regulatory decisions are to be made in short time horizon.

A similar argument on significance of benefit transfer is provided by Boyle and Bergstorm (1992). They stated that the demand for benefit transfer mainly stemmed from high cost and longer time of primary study, and uncertainty of funding. In such a situation benefit transfer is an opportunity. The authors outlined three critical views of benefit transfer in general. Firstly, there is an "impossibility myth", where the observers argue that benefit transfer is not appropriate to measure the recreation value of a policy site. This is mainly due to their doubt about the whole economic valuation process or embedded errors in the benefit estimates. Secondly, the pragmatists, however, view benefit transfer as a practical solution under the situation of limited information and resources. Thirdly, the ideal situation is that the benefit transfer is a feasible solution but requires a standard approach for implementation. It will be reasonable to see benefit transfer from third view point in current situation unless there is a consensus in some standard method(s) of benefit transfer application.

Krupnick (1993) discussed some primary sources of demand for benefit transfer in the United States. When Environmental Protection Agency (EPA) planned to evaluate costs of air pollution in major metropolitan cities the agency used benefit transfer approach. In conducting BCA of phasing down the lead content of gasoline, EPA used existing studies to estimate the values of reducing premature deaths and of avoiding acute health effects by decreasing individual's exposure to lead from gasoline.

Krupnick (1993) also mentioned the natural resource damage assessment model of the United States Department of Interior, which used existing benefit studies on damages to recreational and commercial fishing and hunting from oil spills in the model. Similarly, the United States Public Utility Commission (PUC) uses existing information to formally introduce estimates of the environmental costs of alternative means for generating electricity into the decision making of electric utility.

Next important application of benefit transfer would be for international aid organizations, such as World Bank, the United States Agency for International Development (USAID) and many others, to value the environmental effects of their investment projects (Krupnick, 1993, McConnell, 1992, Desvousges et al., 1998). In this case, transfer of information may take place from developed country to developing ones. Such benefit transfers mainly stemmed from the interest of the agencies involved to introduce a new activity or project in a situation that no prior information relating to the project is available.

Finally, above discussions can be summarized as Brookshire & Neill (1992) put forth compiling the suggestions from McConnell (1992) and Desvousges et al. (1992). The applications of benefit transfers are primarily guided by:

> (1) the inertia created by Executive Order 12291; (2) the cost of primary studies; (3) the lead time involved in conducting primary studies; (4) future increase in the demand by local and state governments; and (5) an increase in the demand of valuation research by international agencies and developing counties (Brookshire & Neill, 1992: 653).

Moreover, benefit transfer is going to be more useful since there have been considerable application of non-market valuation of natural and recreational resources in many countries in recent years. Obviously, benefit transfer would complement this in many cases providing a more efficient and cost-effective option. The difference in the benefit transfer with respect to the international context is that it involves very different socio-cultural and economic issues.

2.3. Development of Approaches

There has been some form of benefit transfer applications in various public agencies and across different disciplines when the information and resource constraints become crucial in their decision making. Apparently, it has been most amenable in valuing the benefit of reducing adverse health effects (Kask & Shogren, 1994; Alberini & Krupnick, 1997; Alberini et al., 1996, Eskeland, 1997; Cropper et al., 1997). There are some quite precise models, even the models in the simple spreadsheet, available to obtain estimates of the health benefits of environmental improvements (Krupnick, 1993).

Moreover, benefit transfer is used extensively in recreation economic decisions. In the development of the benefit transfer process the Water Resources Research, devoted a special issue to benefit transfer in March of 1992 (volume 28, no. 3).

The development of benefit transfer approaches in recreation follows more or less a pattern from the use of a crude unit day value to the recent meta-analysis approach. Brookshire & Neill (1992) classified benefit transfer approaches into three categories: (1) estimates based upon expert opinion; (2) estimates based upon observed behavior; and (3) estimates based upon preference elicitation mechanisms. The unit day value approach may fall into the first category, where the benefit value is chosen with certain expert judgment. The benefit function transfer and the transfer of so called "best" study value may be categorized under second and third classes.

More clearly, the approaches of benefit transfer can be viewed as- (1) Government approved unit day values transfer, such as, U.S. Water Resource Council unit day values; (2) direct transfer; (3) benefit function transfer; and (4) meta-analysis and transfer. Initially, for past quarter century, the U. S. Water Resource Council unit day value approach to water-based recreation benefit transfer relied on expert judgment to develop an approximation of average WTP for outdoor recreation activities (Walsh et al, 1992). The very first establishment of the unit-day value was in 1962 by U. S. Water Resource Council from the review of existing literature. Later in 1979 the literature review by Dwyer et al. (1977) was used to estimate recreational values (Walsh et al., 1992). In the process of estimating the unit day values, the authors commented that the estimated WTP adjusted for characteristics of the study site was selected from a range of updated values approved by federal guidelines, but the exercise became controversial because water agencies questioned the scientific basis of the estimates.

The United States Department of Agriculture, Forest Service developed and used its own unit day values for transfer as part of its implementation of the Resource Planning Act of 1974 (RPA) (Loomis & Walsh, 1997). Periodic update of those values has taken place in every five-year interval. The 1985 RPA values were readjusted based on Sorg and Loomis (1984). The 1990 RPA was founded on the study of Walsh et al (1988). Afterwards, there has been minor adjustment on those values in benefit transfer (Loomis & Walsh, 1997).

Second category of benefit transfer approach is to transfer the existing value directly from a selected best- matched study(s) to the policy site. This approach is often referred as direct benefit transfer or basic transfer in economic literature. This is basically a process of identifying potential candidate study under various criteria and transferring the benefit estimates. In this approach researchers attempt to select the "best" study from the relevant literature and transfers the estimated value from that study to the policy site (Sturtevant, et al., 1998). Some related references on this approach include Desvousges et al. (1992), Luken et al. (1992), and Boyle & Bergstrom (1992).

Third, the benefit function transfer has been an interesting development in this process. In this approach, analysts basically adjust the estimates from study site for differences in site characteristics and demography of the policy site (Sturtevant, et al., 1998). Loomis (1992) describes this as,

> It was not long before university and federal agency economists recognized that a more conceptually sound approach to use and benefit prediction at new sites involved transferring the entire demand equation

> rather than just the average net willingness to pay that results from the demand equation (Loomis, 1992: 701).

The studies in benefit function transfer and related issues are discussed in several studies. Loomis (1992) tested the convergent validity of the benefit function transfer and found that within state transfer model performed well, but across states it did not. Furthermore, Loomis et al. (1995) tested the interchangeability of two specifications of travel cost demand models for recreation at U.S. Army Corps of Engineers Reservoirs using statistical tests of coefficient equality and found them not interchangeable. Loomis et al. conclude that benefit function transfer:

> ... a more limited form of transferability, which focuses on average benefit per day, rather than on predicting total use and total benefits, appears promising (Loomis et al., 1995: 721).

Downing & Ozuna (1996) analyzed the benefit transfer in recreational fishing across time, sites and regions and showed that the benefit function transfer approach tends to over-estimate benefits. The authors indicated that benefit function transfer may be flawed if the estimated function is non-linear, because,

> ... the non-linearity could lead to the case where statistically similar benefit function yield statistically different welfare measures (Downing & Ozuna, 1996: 316).

However, Kirchhoff et al. (1997) considered the non-linearity issue in their analysis and still concluded that the benefit function transfer out-performs direct transfer, and recommended benefit function transfer to be used for policy purposes. The authors compared the direct benefit transfer and benefit function transfer; and suggested that benefit function transfer was more robust than transfer of average site benefit.

Fourth, the most recent approach to benefit transfer is the meta-analysis of existing studies to obtain parameter estimates and transfer the meta-model predicted values to any policy site.

> A meta-analysis of the values from these (existing) studies uses all of the information that is consistently reported in the studies, simultaneously controlling for the characteristics of the resource and the quality and assumptions of the studies (Sturtevant et al., 1998: 203).

Meta-analysis uses benefits estimates, method variables and site characteristics variables from multiple studies as observations and estimates a regression function to be used in benefit transfer. While transferring benefit estimates using meta-analysis, the explanatory variables of the regression can be controlled according to their relevance to the policy site. Sturtevant et al. (1998) further specify,

> Because meta-analysis relies on multiple studies, analysts can minimize the effect of methodological flaws on value estimates by quantifying the influences of these flaws on the value estimates and using that information appropriately in the benefits transfer (Sturtevant et al., 1998: 203).

2.4. Resolving Issues in Benefit Transfer

The benefit transfer in general involves researchers' judgments though it is required in any modeling. In addition to the potential errors in primary studies there are possibilities of errors in the transfer process as well. The best way to resolve such error is to use the judgment based on economic theory, empirical evidence and researchers' experience (McConnell et al., 1992). Luken et al. (1992) indicated the main issues in transferring benefits estimates as differences in site characteristics, quality changes, and market size in terms of participation rate. Similarly, Desvousges et al. (1992) find the problems in the benefit transfer as the differences in benefit types (use and non-use values), quality changes, site characteristics, and market size. Moreover, Smith (1992) views the problem of benefit transfer due to the absence of a systematic protocol for the transfer.

There is little doubt about the *ad hoc* nature of unit-day value estimates in recreation benefit transfer. There are also critical issues with regard to the direct transfer approach due to the difficulties in finding the ideal study, potential influence of study site characteristics in the estimate, and reflections of the limitation of estimation method, if any (Sturtevant et al, 1998).

Validity and reliability are the issues in direct benefit transfer as Boyle and Bergstrom (1992) addressed. Their view is that the transfer estimates must be unbiased, and any replication of the estimates must result smal! variance. The authors suggest analysts collect vital data at both the study site and the policy site to statistically test these conditions. The statistical similarity of the values in two sites would lead to a convergence of the estimates.

Loomis (1992) found the transfer of entire demand function did not pass a statistical test based on similarity of coefficients of the demand equations from study and policy sites. The reasons given were differences in time and purpose of data collection, and site characteristics. Loomis suggests for continued research comparing study and policy sites, which enable researchers to understand the degree of errors in benefit transfer better and be more confident about their benefit transfer estimates.

Atkinson et al. (1992) presented a Bayesian approach to benefit transfer analysis. They observe that benefit estimates have a prior distribution and are not normal due to the dependence between errors and estimates. The argument is that the possibility of transferring benefits is justified from the perspective of the benefit estimates from existing studies being part of a large framework of benefits. The authors claim the Bayesian estimation will increase the efficiency of the estimates.

Furthermore, there are some efforts devoted in using the geographic information system (GIS) approach with TCM benefit transfer to improve the transferability of the benefits. This method has a potential of estimating a better travel cost demand model, which would reflect more consistent benefit value of policy sites (Lovett et al., 1997; Brainard et al., 1998 & Bateman et al., 1999).

Krupnick (1993) indicated benefit transfer involving the environmental effects of foreign aid project in developing countries are limited mainly because of the differences between developed and developing countries on personal income, institutions, cultures, climate, resources, and so on. As Krupnick mentioned the social value system of developing countries, i.e., consideration of some sort of composite welfare of the family or group may be particularly different from the sovereign individual choice behavior of developed countries.

A more recent approach to benefit transfer is the meta-analysis of existing studies and transfer of the resulting benefits.

Walsh et al. (1992) used meta-analysis of existing studies and found the variability in the estimated values mainly because of different users, site qualities, and research methods. Smith & Kaoru (1990) also performed meta-analysis on travel cost recreation studies, and found major issues regarding benefit transfer analysis as modeling assumptions, recreation sites, and openness of social research. But, theoretical model investigation, such as meta-analysis, would enable researchers to develop stronger criteria for benefit transfer.

2.5. Linking Meta-analysis to Benefit Transfer

The above discussion indicates that there is some sort of combination of prior theory with analyst's judgments in typical benefit transfer. Of course, meta-analysis would not remain aloof from this association. Smith & Koaru (1990) suggest the researchers' judgment in meta-analysis combines at least four elements: (1) the problem or issue the empirical model seeks to address; (2) the economic theory or behavior relevant to the problem; (3) the data available to estimate the model; and (4) joint effects of functional specification, variable identification and prior model validation. Smith & Koaru further explain that the variable that is significant in the meta regression model has direct implication for the research in household decision making in recreational activities, further use of the recreational demand models, and for transferring benefits.

> From an analyst's perspective, a meta-analysis provides insight into the variables that are important in the design of future valuation studies as well as in systematically adjusting existing benefit estimates for benefit transfer (Boyle et al., 1994:1057).

This is an econometric-based synthesis of existing literature, which allows researcher to control for the multiple factors intervening in the model that are different in study and policy sites (Boyle et al., 1994; Smith & Kaoru, 1990; Smith & Osborne, 1996; Walsh et al., 1992).

The idea of benefit transfer is that the knowledge accumulated over time may be transferred to a new site, the exact characteristics of which may not be present in any single existing site. Thus, it is argued that meta-analysis results may contain much more information and knowledge compared to the individual studies. This is mainly because an individul research is often justified as the study of a certain system. A meta-analysis of the different studies, therefore, contains more information and knowledge about the system as a whole. This makes it feasible that the meta-analysis result would have more generalizability and a better scope for benefit transfer in the new sites. Bal et al. (1999) states this as follows,

> "Value transfer aims to use cumulative knowledge generated by previous research to draw inferences on hitherto unexplored cases" (Bal et al, 1999: 10).

2.6. Defining Meta-analysis

Meta-analysis is the use of statistical or econometric methods to develop a research synthesis. It is usually described as an attempt to summarize research findings and improve the quality of literature reviews involving empirical studies (Smith, 1992). In the beginning most of the meta-analysis applications were seen in controlled experiments in psychology, education and health sciences (Smith & Koaru, 1990). Meta-analyses in those disciplines were focused consistently on aggregating the results from different controlled experiments. Initially, it was introduced in order to avoid more narrative review of literature.

Glass et al. (1981) defined meta analysis as the method of integrating empirical research. More importantly,

> "it is a matter of communicating the findings and knowledge of empirical inquiry" (Glass et al., 1981: 9).

The authors suggested that the method was developed in search of a statistical methodology to integrate the findings of empirical research in social science that grew exponentially in the middle of 20th century.

This is, "quantitative summarizing of individual studies ... by recording the properties of studies and their findings" (Glass et al., 1981:21).

Gene V. Glass was the first, who used the term meta-analysis in 1976 though the issue of combining prevailing research has much longer history (Cook et al., 1992:6). Glass (1976) referred meta-analysis as the analysis of analyses. The term comes from the spirit of "meta-mathematics", "meta-psychology", or "meta-evaluation" (Glass, 1976:3). He used this term to refer to the statistical analysis of a large collection of empirical results from individual studies.

There is a difference in the use of meta-analysis methods in education, psychology or in medical research, compared to its application in economics (Smith & Koaru, 1990). Most meta-analyses have summarized effect sizes (for applications in education or psychology) or evaluated the evidence from test results across a variety of different types of experiments (Smith & Huang, 1995). All of the former involved controlled experiments where the statistical analysis can be treated as aggregating independent observations from each study's sample of experimental design. But in recreation economics, or more specifically in recreation benefit transfer, controlled experiment is not available. Recent application of meta-analysis in recreation economics is inspired by the analysts' interest on benefit transfer.

"Benefit transfer research draws on standard procedures developed by meta analysis, the growing science of reviewing research" (Walsh et al., 1992:707).

2.7. Meta-analysis in Social Science

Meta-analysis is used much more often in other social sciences than in recreation economics. Despite its development mostly in education, health science and psychology, meta-analysis is more recently applied in different behavioral sciences and economics (Smith & Kaoru, 1990; Phillips & Goss, 1995; Espey, 1996; Epsey et al., 1997; Hughes et al., 1997; Assmus et al., 1994, Baaijens et al., 1998).

Manfredo et al. (1996) used meta-analysis to study motivations for leisure, where authors attempted to provide a summary integrative analysis of the structure of the recreation experience preference through meta-analysis of existing studies.

Smith & Osborne (1996) used meta-analysis for testing the theoretical properties of an underlying behavioral relationship in contingent valuation estimates of visibility. They tested whether the CV estimates of WTP are responsive to scope, i.e., amount of the environmental amenity being offered; and found a positive and significant relationship between the WTP estimates and the percentage improvement in visible range offered in the CV studies.

Smith and Huang (1995) used meta-analysis in synthesizing studies regarding reduction of particulate matter in valuing air quality improvement using hedonic property models. Boyle et al. (1994) used meta-analysis to statistically investigate whether existing contingent valuation of groundwater protection collectively provide clear picture of the benefits of the groundwater protection.

2.8. Application of Meta-analysis in Benefit Transfer

In the search for a better method to transfer benefits from existing recreation benefit studies, meta-analysis appears promising. This is primarily because a potentially useful approach to the benefit transfer problem would be to pool the data from existing studies and apply multiple regression analysis to capture the explanatory power of those variables.

> If the basic model specification is complete, that is, if it includes the relevant explanatory variables in the correct functional form, then it could explain the variation in benefits embodied in differences among the explanatory variables (Walsh et al., 1992: 707).

Then, the benefit estimated for the study site can be used to estimate the benefit for policy site, which is lacking valuation information, by substituting relevant values in the explanatory variables of the model (Walsh et al., 1992, Sturtevant et al., 1998). Krichhoff (1998) illustrates the basic approach of using an estimated meta-equation to predict consumer surplus values. She, then, evaluated the relative accuracy of the meta-analysis derived benefit transfer as compared to the original study and a benefit function transfer. She found that multi-site benefit functions outperformed meta-analysis, but that meta-analysis outperformed single-site benefit function transfer. However, in light of the bias of her evaluation criteria toward benefit function transfer, she concluded that the use of meta-analysis for benefit transfer was still encouraging. Sturtevant et al. (1998) supported this conclusion by showing that, in general, estimates from the meta-analysis were more precise than point estimate transfers.

There have been very few economists in the United States, who have used this method of analysis to synthesize results from recreation demand studies. Smith and Koaru

(1990), Walsh et al. (1992), and Sturtevant et al. (1998) are known contributors. Similar efforts have been made on meta-analysis approach to benefit transfer in Europe (Brouwer et al., 1999, Nijkamp et al., 1999). In 1998, an entire workshop on meta-analysis for the purpose of benefit transfer was held at the Tinbergen Institute in Amsterdam. But, the workshop proceeding is not yet available.

PART III

METHODOLOGICAL CONTRIBUTON AND EMPIRICAL RESULTS

Part III of this dissertation contains Chapter 3 and 4. Chapter 3 develops an economic framework of benefit transfer in non-market valuation of recreational resources. Also, this chapter includes the approach of meta-analysis in benefit transfer as well as the econometric modeling technique in meta-analysis. The empirical results of meta-regression models and the framework of the model application in benefit transfer compared with other techniques are discussed in Chapter 4.

CHAPTER 3

Research Methodology and Econometric Modeling

3.1. Benefit Transfer Framework

3.1.1. Economic Model for Benefit Transfer

Economic models attempt to reflect real world human behavior in their decision making though the analysts may not necessarily know the actual process underlying people's behavior. Moreover, there will never be a possibility of obtaining complete information determining every individual's preference and choices. This leads to some sorts of errors in every modeling. Smith (1992), therefore, asserts that all applied models are wrong in some sense, but a more relevant question is how critical those errors are to the particular modeling objective. As discussed in earlier chapters, there are situations where high degree of precision may be impossible or even irrelevant in some cases with regard to recreation benefit transfer. More importantly, there is a trade-off involved in going for a primary research rather than using benefit transfer in recreation economic decisions.

> "... transfer method can be evaluated in a more general setting where new research is considered within a value-of-information framework" (Smith, 1992: 686),

Regardless of the modeling assumptions a primary research model development is not an option when we deal with benefit transfer. Considering the importance of benefit transfer in public decision making under limited information and resources, the possibility of a generalized model is already excluded. Similar to what we have reviewed earlier, Smith (1992) justified this idea based on following three reasons. Firstly, policy making agency may have specific short-term view of the problems largely determined by time and resources. Secondly, even with sufficient time and resources some physical conditions may have to be met for primary research such as evaluating the benefit of in-stream flow after dam construction may be difficult. Thirdly, there is a potential of using existing research to have better understanding of the problem and to develop transfer methodology. Modeling for meta-analysis and benefit transfer is based on those underlying reasons:

> As a rule, the available models have been designed for specific situations, and the transfer requires applying one or more of them to a different situation. Once models are recognized as approximations, we can ask whether the specification developed for a typical model can be applied to a similar context (Smith, 1992:683).

3.1.2. Conceptual Framework of Meta-Analysis in Benefit Transfer

As discussed in the introduction and literature review of this dissertation, benefit transfer application has been extensively practiced in recreation economic decision-making, though it is not infrequent in other area of natural resources and environment planning and management. There are several approaches developed in benefit transfer applications in outdoor recreation since its first initiation of unit day value transfer. There are also analyses and testing in greater details regarding direct benefit transfer and benefit function transfer. However, the benefit transfer using meta-analysis is relatively new.

Though with different interest and research needs, meta-analysis that has been evolved largely in other disciplines has shown promising application in economics. This is briefly outlined in Fig 3.1, where it is indicated that meta-analysis among other approaches has been applied to synthesize research outcomes in education, health science, psychology and other social sciences. In recreation, various benefit transfer approaches are developed, but meta-analysis has shown a promising application relatively recently. Thus, the figure attempts to show the convergence between benefit transfer approach and meta-analysis application, developed independently in different fields.

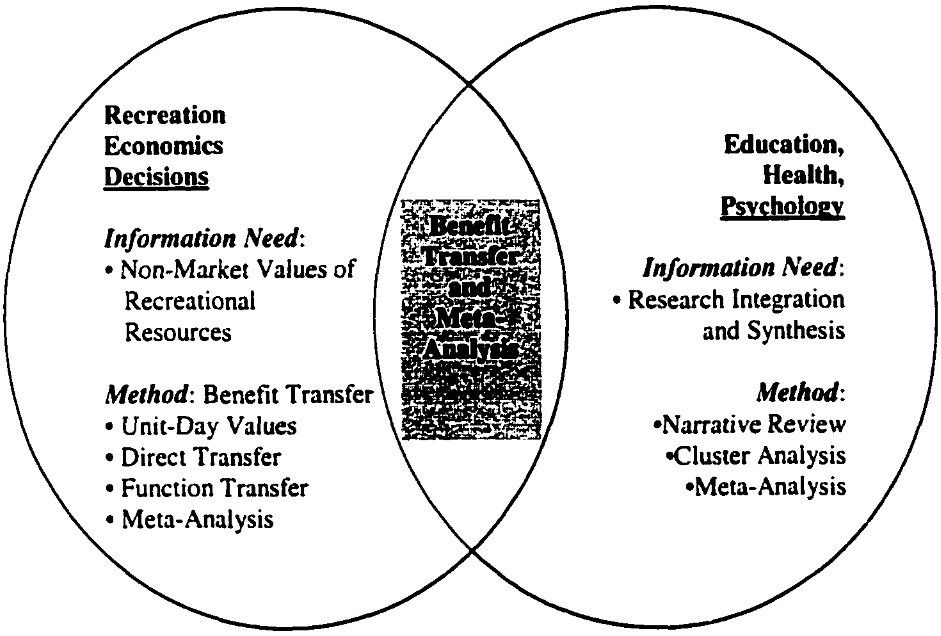

Figure 3.1: Benefit Transfer with Meta-Analysis Framework.

3.2. Benefit Estimation and Transfer Model

3.2.1. Consumer Surplus Estimation

Basic modeling framework of benefit transfer intends to reflect the situation where the benefit estimates from existing studies can be used to estimate the benefits of a different policy site that reflect the value of the resources of the site. Thus, the primary model represents the recreational value of the resources in the study site. We formulate a simple model to represent consumers' preferences in the study site. Let the direct utility function be of following form:

$$\max_{x,z} \quad u(x,z \mid a,s) \quad \text{subject to} \quad px + qz = y \tag{3.1}$$

where,

x = quantity demand of the recreational activity, e.g., # of trips in a site;

z = quantity of all other goods consumed;

a = vector of exogenous attributes of the activity or site;

s = vector of socioeconomic characteristics.

p = cost/price of recreation trip;

q = vector of prices of other goods and services

y = income

From above maximization of utility function subject to budget constraint we derive the Marshallian demand of the form:

$$x = f(p,q,a,s,y) = -v_p(p,q,a,s,y)/v_y(p,q,a,s,y) \tag{3.2}$$

The right hand side of equation 3.2 is the Roy's identity, which links the Marshallian demand to the Hicksian demand. Integrating the Marshallian demand function gives an approximation of the annual consumer surplus to an individual. While integrating the Marshallian demand instead of the Hicksian demand, certain assumptions have to be made regarding the associated errors. It is assumed that the error imposed by this selection is small compared to the estimation error (McConnell, 1992). McConnell refers to Willig (1976) regarding the approximation formula, and suggests,

> "the upper bound of the percent error caused by using consumer surplus rather than compensating variation is likely to be small for recreational services, even when the income elasticity is large, because consumer surplus as a percent of income is quite small" (McConnell, 1992: 696).

Two types of surpluses could be observed:

(a) Value of recreation with access to the site:

$$\int_{p^o}^{p^*} f(p,q,a,s,y)dp = w_1(p^o,q,a,s,y) \tag{3.3}$$

where,

P^o = current value

P^* = choke value

(b) Value of recreation with change in site quality:

This mainly refers to the change in the quality of an attribute (a) in a particular site from a to a*, not a change in the access to the resource.

$$w_2(p^o,q,a^*,a,s,y) = w_1(p^o,q,a^*,s,y) - w_1(p^o,q,a,s,y) \tag{3.4}$$

An aggregate benefit of the access to the site is, then, a simple summation of the benefit across users. This can be represented as follows,

$$W_1 = \sum_{i=1}^{N} w_1(p_i^o, q_i, a_i, s_i, y_i) \tag{3.5}$$

where, i = 1 ... N, the number of users,

and for a change in site quality,

$$W_2 = \sum_{i=1}^{N} w_2(p_i^o, q_i, a_i^{*} a_i, s_i, y_i) \tag{3.6}$$

In above representation, most of the time the benefit transfer modeling of non-market value of outdoor recreation measures the site value as value of access to the site, but not value of a change in the quality of the resource in the site (McConnell, 1992). The consumer surplus per person in equation 3.3 is often divided by seasonal trips (days) to yield an average consumer surplus per trip (per day). This per unit value is often the focus of the transfer from the study site to the policy site. Morey (1994) discussed the derivation and the assumptions about using a value per day measure.

In above specification the site characteristics and socioeconomic attribute vector represents important information for benefit transfer (Boyle & Bergstrom, 1992). Thus, these attributes should match with policy site for the benefit transfer to be appropriate. The site characteristics may include, resource type, degree of crowding, in-stream flow, location, etc. where as socioeconomic attributes can be age, sex, income, experience etc. The information and knowledge of these features allows researcher to evaluate the benefit estimate or even systematically adjust the values to reflect the approximate estimates. In meta-analysis the model itself objectively accounts for these features and potentially provides better estimates.

3.2.2. Consumer Surplus (Benefit) Transfer

Before the estimate of the existing studies is ready to transfer to the policy site, one has to ensure that the estimate across the studies is unbiased and efficient. Then, further condition would be to compare the attributes of the estimates between study site and the policy site.

(a) Intrasite unbiasedness and efficiency requirement:

A simple condition for unbiasedness across study sites would be to check whether the expected value of the welfare measure in the study site(s) is equal to the population mean. This can be expressed as intrasite unbiasedness condition. This is particularly important not because a biased estimate should not be transferred, but it should be evaluated on the basis of the precision required for a particular benefit transfer. A small bias may be acceptable in most benefit transfer in recreation. An intrasite unbiasedness criterion can be expressed as follows:

$$E(w_i^{ss}) = \mu_i^{ss} \qquad i = 1 \ldots n, \qquad (3.7)$$

where,

ss = study site

(b) Intersite validity requirement:

This indicates that the benefit transfer criteria would be met if the non-market value of the resource in the study site is identical to that of the policy site (Boyle & Bergstrom, 1992). If it holds, then, the benefit estimates of study sites could be directly transferred to the policy site. To find the expected value of the policy site the analyst may conduct a key informant survey to obtain the information from other sources. An intersite unbiasedness criterion can be expressed as:

$$E(w_i^{ss}) = \mu^{ps} \qquad i = 1 \ldots n, \tag{3.8}$$

where, ps = policy site

It is likely that this condition does not hold in a benefit transfer. Then, the question will be again researchers' judgment on the level of error to be accepted. This will, of course, require one to compare the trade-off between using the estimates with some errors or not using it at all.

Meta-analysis is an approach that systematically allows one to net out much of the intersite biasedness using the relevant variables in the meta-model. The meta-regression model requires the study sites characteristics including methodological variable enter into the model. Moreover, since the meta-estimate is the result of the comprehensive model specification this would potentially better match with the policy site attributes, and eliminate or minimize intersite biasedness.

Smith (1992: 692) states, "Meta-analysis helps to identify the direction and magnitude of the effects of modeling judgments on benefit estimates and also provides a plausibility check on the results derived from model transfers".

3.2.3. Raw Average Benefit Estimation and Transfer

A raw average WTP value for each activity across regions and for the nation as a whole is calculated from the database. In the calculation process, these point estimate WTP values were converted to per person per day values and also adjusted to 1996 dollars. Then the database was sorted by census regions of the United States and by recreation activity in each region. Each average WTP value for an activity under individual region is given by following expression,

$$\overline{X}^{r}_{a} = \tfrac{1}{n}\sum_{i=1}^{n} X_{ij} \qquad (3.9)$$

where,

$\overline{X}$ = average estimates of WTP

a = 1, ..., 21; recreation activities

r = 1, ..., 5; census region of the USA

i = 1, ..., n; number of observations

j = 1, ..., k; numbers of studies

Similarly, the national average WTP values for each activity were also computed based on following expression.

$$\overline{X}_{a} = \tfrac{1}{n}\sum_{i=1}^{n} X_{ij} \qquad (3.10)$$

where,

$\overline{X}$ = average estimates of WTP

a = 1, ..., 21; recreation activities

$i = 1, \ldots, n$; numbers of observations

$j = 1, \ldots, k$; numbers of studies

3.3. Meta-Econometric Model and Estimation

3.3.1. Panel Nature of Data with Multiple Estimates from Same Study

The datasets for most meta-analyses of recreation and environmental valuation studies are of the panel type, that is, they contain multiple estimates from each study (Walsh et al., 1989, 1992; Smith and Kaoru, 1990; Boyle et al., 1994; Smith and Huang, 1995; Smith and Osborne, 1996; Espey et al., 1997; Desvousges et al., 1998; & Sturtevant et al., 1998). These multiple value estimates can result in additional, yet unobservable, systematic effects that are not accounted for in the variable specification of a classical regression model. Sturtevant et al. (1998) and Desvousges et al. (1998) are the studies, which explicitly used panel estimators for their models.

To investigate the difference between OLS and the panel model, consider the classical OLS model:

$$y_i = \mu + \beta' x_i + \varepsilon_i, \qquad (3.11)$$

where i indexes each observation, y is the dependent variable (in this case, consumer surplus per person day adjusted to 1996 dollars), x is a vector of explanatory variables including methodology, site, and user characteristics, and ε is the classical error term with mean zero and constant variance σ^2_ε.

A generic panel model is:

$$y_{ji} = \mu_j + \beta' x_{ji} + \varepsilon_i \qquad (3.12)$$

where *j* indexes the individual study. Accounting for the panel nature of the data when estimating a statistical model is important because of the potential unobserved correlation of a unit's multiple observations. Classical regression models are inefficient if they cannot account for this correlation of the observation unit's multiple responses, if said correlation is present. An additional feature on the panel nature of the data is that it is unbalanced, that is, there is no uniform number of observations from each unit. Each study has at least one, but can have several value estimates.

3.3.2. Candidate Panel Models: Fixed Effect and Random Effect

The panel data effects can be modeled as either having an unit-specific constant effects or an unit-specific disturbance effects.[1]

The fixed effect model treats the panel effect as an unit-specific constant effect. The group effect parameter, μ_j, in the case of the fixed effect model, takes on the form:

$$y_{ji} = \alpha_j d_{ti} + \beta' x_{ji} + \varepsilon_i, \qquad (3.13)$$

where d_{ti} is a dummy variable taking on a value of one for all observations where $j = t$. The first term can be reduced to α_j, signifying a group effect constant for each study in

[1] Desvousges et al. (1998) identify candidate models for meta-analysis as being a no effect model (the classical OLS), a fixed effect model, a random effect model, and a Bayesian approach. Sturtevant et al. (1998) test a fixed effect, random effect, and a separate variances model (no common error term).

meta-analysis. Then, the fixed effect model is simply the classical regression model with unit-specific constants.

The random effect model treats the panel effect as a unit-specific disturbance effect. The group effect parameter, μ_j, in the case of the random effect model, can be written as:

$$y_{ji} = \alpha + \beta' x_{ji} + \varepsilon_{ji} + \mu_j, \tag{3.14}$$

where μ_j is the unit-specific disturbance effect and has a mean zero and variance σ^2_μ.

Each study has an overall variance:

$$\mathrm{var}[\varepsilon_{ji} + \mu_j] = \sigma^2 = \sigma^2_\varepsilon + \sigma^2_\mu. \tag{3.15}$$

The random effect model is a generalized regression model with generalized least squares being the efficient estimator.

The two test statistics that aid in choosing between classical OLS, fixed effect, and random effect models are Lagrange multiplier statistic and chi-squared statistic. Breusch and Pagan's Lagrange multiplier statistic tests whether a group effect specification is significant (H_0: $\mu_j = 0$). Hausman's chi-squared statistic tests the random effect model against the fixed effect model (H_0: μ_j as a random effect; H_1: μ_j as a fixed effect).

3.3.3. Pooled vs Disaggregated Models: Hypothesis Tests

An additional issue with this data is whether all the studies can be pooled to estimate a single national model, or whether separate geographic regional models should be estimated. Separate regional models are preferred if the regions are structurally different in either the intercept parameter(s) or slope parameters. A Chow test (F-test) (Greene, 1993: 349) can be performed on the data to determine if the data can be pooled to estimate a national model, or whether regional models should be estimated. The hypotheses are:

H_0: National model, α_r's = α_n's, and β_r's = β_n's, (3.16)

H_1: Regional models, at least one $\alpha_r \neq \alpha_n$, or at least one $\beta_r \neq \beta_n$,

where the *r* subscript refers to the estimated regional model coefficients and the *n* subscript refers to the estimated national model coefficients. That is, if at least one region-specific constant or region-specific slope parameter is different from the others, then pooling the data to estimate a national model imposes a restriction on the coefficients.

3.4. Testing the Performance of Meta-Regression for Benefit Transfer

3.4.1. In-Sample Comparisons Involving Individual Study Values

One means to evaluate the relative accuracy of the predictions from the meta-analysis equation is to compare the predictions to the actual individual study values. While the model R^2 provides some indication of goodness of fit, our main interest is in whether the dollar magnitude of the errors would be acceptable for a benefit transfer exercise. Further, we are interested in whether the meta-analysis estimated values are less subject to small sample errors likely to arise from simply averaging the few available studies for that recreation activity in that region.

3.4.2. In-Sample Comparisons Involving Regional Average Values

Some government agencies perform benefit transfer by relying upon a set of standardized "unit day values". The USDA Forest Service has done this since 1980 using their Resources Planning Act values. In the last decade, these values have been specific to groups of similar activities and region of the country. The U.S. Bureau of Reclamation and U.S. Army Corps of Engineers have relied upon the U.S. Water Resources Council unit day values for decades.

Recently, the USDA Forest Service has investigated the possibility of using consumer surplus estimates from a meta-analysis equation to fill in the missing values in their recreation activity by region matrix. Thus another evaluation is to compare original study values averaged by recreation activity and region to the meta-analysis equation estimates of these same values for cells in the table that have original study values. This may provide some indication of the relative accuracy of using the meta-analysis equation to fill in the missing values in the table.

3.4.3. Evaluation of Out of Sample Convergent Validity

Another way to evaluate the performance of a meta-regression model is to compare its estimates to those from original studies that were not used to estimate the model. These observations can be from the same time period or literally out of the sample time period. This framework of analysis will be applicable for national and international out-of-sample benefit transfer evaluation.

3.4.4. Hypothesis Test on Out of Sample Validity

While testing convergent validity of the estimates predicted by meta-regression, for example, predicted value using meta-regression versus the original value estimated in the out of sample studies, we will be able to use a simple hypothesis test as:

$$H_o: \quad \overline{WTP}^{meta} - \overline{WTP}^{original} = 0 \qquad (3.17)$$

$$H_1: \quad \overline{WTP}^{meta} - \overline{WTP}^{original} \neq 0$$

There would be various test statistics to test the above hypothesis: (1) overall paired t-test, to see if the meta-equation predicted value and original WTP values are the same, (2) testing confidence interval (CI) on individual estimates to test whether use of regional vs national meta-model makes any difference in WTP estimates, and (3) Pearson's correlation coefficient to measure the degree of association between predicted and original study values.

3.5. Data Sources

Since benefit transfer using meta-analysis is an approach entirely based on existing studies it has some specific methods of gathering data and information. First, it is fully dependent on the studies that have already been done. If a few or no studies exist, no useable data would be found in the area of interest. Second, even if studies are done, it is often difficult to locate them as many are unpublished. In many cases, the information about the existence of the study has to be obtained from the authors or experts. Third, even after knowing about the availability of the study, it can take substantial time and effort to obtain a copy of the studies. Thus, while it is not too costly to collect the data for the meta-analysis research, it is contingent upon accessibility of the information. This can be almost impossible if a reasonably good database and technical facilities are not readily available.

In the United States there are reasonably large number of outdoor recreation valuation studies and they are quite well documented. Since this research also updating the previous literature review effort of Walsh et al. (1988), new valuation studies performed since then had to be collected. Thus, the data search was limited to studies from 1988 to the present. Study values for years prior to this were also obtained from MacNair's (1993) database previously assembled for the USDA Forest Service. Therefore, the database contains the Walsh et al. (1988), MacNair (1993) and the current data covering from 1967 to 1998.

3.5.1. Data Search and Limitations

We searched a wide range of electronic databases including the American Economic Association's Econ Lit, First Search Databases, the University of Michigan-Dissertation and Thesis Abstracts, National Technical Information Service (NTIS) database and Water Resources Abstract Index. Unpublished or gray literature were also searched using W133 Proceedings from 1987 to 1996. Carson et al.'s (1994) CVM bibliography as well as researchers' own collections of working papers, conference papers and reprints provided an excellent source of information.

There are two distinct views regarding the inclusion of the studies in meta-analysis. Traditionally, it has been focused much more on meta-analysis considering a comprehensive literature search and also including all available studies in the analysis. This approach has been practiced primarily to avoid publication or reporting biases in the meta-analysis (Olkin, 1990 and Light & Pillemer, 1984). But, another view on this is to focus on understanding science in meta-analysis than just doing a literature review. This is a different idea in considering studies for meta-analysis, which excludes all imperfect studies that could potentially distort the expected results of meta-analysis (Rubin, 1990). The meta-analysis in this dissertation is based on a comprehensive literature search.

The literature search for meta-analysis covered the studies in the U.S. but included Canadian studies as well. The studies in Europe as well as the other countries were considered later in testing the meta-models for the international benefit transfer analysis, but not in the meta-regression model estimation.

The recreational fishing studies were not emphasized in this study as those were covered in two previous significant literature reviews: (a) Sturtevant et al. (1998); and (b) a joint effort directed by Kevin Boyle and Industrial Economic Incorporated (Markowski et al, 1997). However, the previous literature of Walsh et al. (1988) and McNair (1993) contain a large number of fishing studies, which were included in this meta-analysis. The initial study coding sheet was also patterned after Markowski et al.'s (1997) to maintain comparability.

3.5.2. Coding Procedures

A master coding sheet was developed (see Annex 3.1) and used to code the studies collected, and to guide the recoding of the MacNair (1993) database. The main database of values that underlies the averages contained 126 fields, with the last field being a comment section. There were five main coding categories:

(i) Complete citation to the study;

(ii) The nature of the benefit measure (e.g., WTP vs WTA, mean vs median);

(iii) Details of CVM application if CVM used;

(iv) Details of TCM application if TCM used; and

(v) Study location details (e.g., whether National Forest, Park, State Park, etc.), environment type (e.g., forest, wetland), recreation activity, etc.

The information, such as, whether the study provided an estimate of a site-specific, state, regional or national average recreation use value were also recorded. Census Regions represent the four Assessment Regions (CR1: Northeast, CR2: Southeast, CR3: Intermountain and CR4: Pacific, as well as a separate region for CR5: Alaska). For USDA Forest Service, RPA purposes, the USFS Regions were also recorded (e.g., R1=Montana and North Idaho; R2=Wyoming and Colorado; R3=Arizona and New Mexico; R4=Nevada, Utah and South Idaho; R5=California; R6=Oregon and Washington; R8= Southeastern U.S.; R9=Northeastern U.S.; R10=Alaska; note R7 does not exist).

In the past, the RPA average recreation values were reported per USFS Region. However, this results in two problems: (a) very small sample sizes per activity/region cell; and (b) numerous activity/region cells with no average value (due to the lack of original studies). To address both of these problems, the USFS Regions were aggregated into the Census Regions.

All study values were updated from their original study year (not publication year) values to 1996 dollars using the Implicit Price Deflator. Originally there were slightly more than 170 individual studies that produced slightly more than 750 individual values. Some studies were removed from the database because they did not report enough information to convert their reported units to a per day basis. This has often been the case in most meta-analyses and benefit transfers as to make the analysis more consistent and result more reliable (Brouwer et al, 1999). Finally the database contains 163 studies providing 741 individual values. Due to recoding of MacNair's (1993) values into the database, this research covers studies dating to 1967, although the majority of the values are from the 1980's and 1990's.

There have been some judgments made during coding process, including recalculation, adjustment and removal. This has been done by a panel of researchers consisting of four graduate students and the project director all from the Department of Agricultural and Resource Economics. The use of a panel of experts in evaluating the studies to be included in the meta-analysis is one of the ways to improve the quality of the meta-analysis (Light & Pillemer, 1984). In the data generating process effort was made to address all relevant issues.

CHAPTER 4

Benefit Transfer Model Results and Discussion

4.1. Average Recreational Value Estimates

An average value for each recreational activity was estimated for five census regions and also computed a national average. There were 21 recreational activities categorized based on Sorg & Loomis (1984), Walsh et al. (1988, 1992) and other USFS literature. The activities, which were not compatible with any of the above 21 categories were coded as "others" (see Table 4.1).

The average WTP values were computed excluding the outliers, i.e., the values above the two-standard deviations from their mean (but those outiers were retained in meta-analysis, see Annex 4.2). There were 701 observations from 158 studies in total when the outliers were excluded in the raw average value estimation (see Annex 4.1). The average values and corresponding sample size by activities and regions are reported in Table 4.1. The average value table shows the mean WTP values ranging from $8.40 for motor boating in southeast region to $85.74 for rock climbing in northeast region. When we include Canadian studies the lowest mean WTP appears to be $3.33 in other recreation category. There are maximum 65 observations for big game hunting in intermountain. This activity also has highest observation in the nation as a whole.

Table 4.1: Mean Recreation Values Per Person Day by Activities and Census Region.

(in 1996 U.S. dollars)

Activity/Region	N	NOREAST	N	SOUEAST	N	INTERMT	N	PACIFIC	N	ALASKA	N	National Values	N	U.S. Average	N	Canada
Camping	6	27.70	7	17.91	20	25.06	2	77.27			1	28.61	36	35.31		
Picnicking	1	55.22	1	37.24	4	22.95	3	53.52			1	15.69	10	36.92		
Swimming	5	22.79	1	16.75	1	24.62	3	28.74			1	20.67	11	22.72		
Sightseeing			3	25.42	8	16.26	1	50.64			1	18.83	13	18.53		
Off-Road Driving					1	11.76	1	33.64			1	19.94	3	21.78		
Motor Boating	1	66.75	2	8.40	6	37.86	4	21.69			1	21.61	14	31.26		
Float Boating	3	40.54	1	15.04	6	50.48			1	15.13	1	38.70	14	31.98		
Hiking/Backpacking	3	53.52	2	9.47	5	31.85	8	32.37	1	12.93	1	20.87	20	26.84		
Biking	1	34.11	1	56.27	2	58.89					1	17.61	5	41.72		
Downhill Ski					2	23.23	1	20.90			1	19.61	4	21.25		
Cross Country Ski	3	28.83			7	24.90	1	40.32			1	13.20	12	26.81		
Snowmobiling					2	69.97							2	69.97		
Big Game Hunting	54	42.18	26	35.99	65	41.46	11	43.77	5	52.40	1	15.98	162	38.63	3	35.60
Small Game Hunting	3	36.73			13	25.75	1	27.37			1	15.87	18	26.43		
Waterfowl Hunting	22	27.06	11	17.70	16	23.17	4	23.79	1	60.08			54	30.36		
Fishing	40	23.33	13	27.74	36	32.45	15	36.97	1	39.22	4	37.26	109	32.83	4	55.15
Wildlife Viewing	55	26.06	38	29.50	38	32.80	14	30.45	5	43.13	1	17.06	151	29.83		
Horseback Riding											1	15.10	1	15.10		
Rock Climbing	2	85.74			3	42.04							5	63.89		
Wilderness Recreation	4	19.64	1	17.39	6	26.83	5	39.16					16	25.76		
General Recreation (mean of all types)	8	15.21	6	14.65	17	21.78	12	16.93	3	11.84			46	16.08		
Others			2	26.21	9	33.03							11	29.62	3	3.33
Total # of cases	207		114		263		81		17		19		701		10	

N = Number of observations

4.2. Meta-Analysis Models Results and Discussion

All of the meta-regression models were estimated using EVIEWS econometrics software. Table 4.2 lists and defines the variables tested across the models. Out of the 741 observations recorded, 682 had reported enough information to fully code for each of the variables listed in table 4.3. The mean values of those variables are reported in Annex 4.5, depending on the segregation of the data by entire nation and census regions. This analysis includes full dataset including outliers. These 682 observations were obtained from 131 separate studies of the United States. The number of estimates per study ranged from 1 to 134.

If there is correlation among these multiple observations for each study, then OLS assumptions are violated. While these studies may provide estimates that relate to tests of methodology, different sites, or different activities, there may still be an unobservable, yet systematic effects of the study on their estimates. It was largely believed that panel models could account for these unobservable systematic effects. However, in the analysis by Loomis et al. (1999) using fixed effect and random effect models the authors concluded that no significant panel effect was found. The random effect specification was rejected in favor of fixed effect specification and the classical OLS specification was favored over fixed effect specification.

With the above finding, the classical OLS was considered as the meta-model in further analysis and interpretation in this study. Initially, a fully specified meta-regression model was estimated (see Annex 4.3), then, the separate optimized national as well as regional models were estimated for benefit transfer analysis retaining only those variables significant at the 20% level ($p<0.2$).

Table 4.2: Variables Tested in the Meta- Regression Models.

Variables		Description
Dependent variable:		
CS		Consumer surplus per person day (1996 dollars).
Method variables:		
METHOD	–	Qualitative variable: 1 if stated preference (SP) valuation approach used; 0 if revealed preference (RP) approach used.
DCCVM	+	Qualitative variable: 1 if dichotomous choice elicitation technique in SP was used; 0 if otherwise.
OE	–	Qualitative variable: 1 if SP and open ended elicitation technique was used; 0 if otherwise.
PAYCARD	–	Qualitative variable: 1 if SP and payment card elicitation technique was used, 0 if otherwise.
RPSP	–	Qualitative variable: 1 if SP and RP was used in combination, 0 if otherwise.
INDIVID	+	Qualitative variable: 1 if RP approach was an individual model; 0 if otherwise.
RUM	–	Qualitative variable: 1 if RP was a random utility model, 0 if otherwise.
SUBS	–	Qualitative variable: 1 if demand model incorporated substitute sites; 0 if otherwise.
MAIL	–	Qualitative variable: 1 if survey type was mail; 0 if otherwise.
PHONE	–	Qualitative variable: 1 if survey type was phone; 0 if otherwise.
LOGLIN	±	Qualitative variable: 1 if regression function was estimated as log dependent variable and linear independent variable; 0 if otherwise.
LOGLOG	±	Qualitative variable: 1 if regression function was estimated as log on both dependent variable and independent variable.; 0 if otherwise.
VALUNIT	–	Qualitative variable: 1 if consumer surplus was orginally estimated as per day; 0 if otherwise.
TREND	+	The year when CS estimate was recorded, coded as 1967=1, 1968=2, . .. 1996=30.
Site Variables:		
FSADMIN	–	Qualitative variable: 1 if the study sites were National Forests (i.e., administered by the U.S. Forest Service); 0 if otherwise.
R2, R5, R6, R8, R9, R10	±	Qualitative variables: 1 if study sites were in the respective USFS Region; 0 if otherwise (see Annex 4.4).
LAKE	–	Qualitative variable: 1 if the recreation site was a lake; 0 if otherwise.
RIVER	+	Qualitative variable: 1 if the recreation site was river; 0 if otherwise.
FOREST	±	Qualitative variable: 1 if the recreation site was forest ; 0 if otherwise.
PUBLIC	+	Qualitative variable; 1 if ownership of the recreation site was public; 0 if otherwise.

Table 4.2: Continued ....

Variables		Description
DEVELOP	±	Qualitative variable: 1 if the recreation site had developed facilities, such as picnic tables, campgrounds, restrooms, boat ramps, ski lifts, etc.; 0 if otherwise.
NUMACT	+	Quantitative variable: the number of different recreation activities the site offers.
Recreation activity variables:		
CAMP . . . GENREC	±	Qualitative variables: 1 if the relevant recreation activity was studied; 0 if otherwise. Where CAMP is camping, PICNIC is picnicking, SISEE is sightseeing, OFFRD is off-road driving, BIKE is biking, DHSKI is downhill skiing, XSKI is cross county skiing, SNOWMOB is snowmobiling, BGHUNT is big game hunting, WATFOWL is waterfowl hunting, FISH is fishing, WLVIEW is wildlife viewing, ROCKCL is rock climbing, HORSE is horseback riding, and GENREC is general recreation.

4.2.1. Meta-Regression Models for Benefit Transfer

Five meta-models were estimated one for each of the geographic regions and one national model. The model specifications were based in part on the Walsh et al. (1989, 1992) and Smith and Kaoru (1990) studies. To this list of variables we added specific ones that believed to be useful such as state level income per capita derived from U.S. Bureau of Census data. All models were estimated using the classical OLS regression technique. The analysis was performed using EVIEWS econometrics software. Each model was optimized individually by retaining only those variables that were significant at the 0.20 level based on t-statistics. This was considered to make application of meta-regression models for benefit transfer as effective as possible. Variables that are consistently insignificant are discussed in section 4.2.2.

The five models estimated include a pooled national model and four regional models. The regions are defined based on USDA FS Resources Planning Act Assessment Regions, which closely coincide with the Census Regions. We label each of the regional models as CR1 (northeastern states), CR2 (southeastern states), CR3 (intermountain west), and CR45 (pacific states plus Alaska). While there are five Census Regions, due to lack of degrees of freedom for CR5, Alaska, we tested using a Chow test (Greene, 1993:349) of coefficient equality and found that we could combine CR5 with CR4, the pacific states, thus preserving degrees of freedom. The Chow Test result is discussed in section 4.2.3.

Table 4.3 presents the final estimated models, mean value of which are presented in Annex 4.5. The explanatory power of the national model is 0.27, slightly below that of Walsh et al. (1989, 1992) for their combined TCM/CVM Model. The regional models all had greater explanatory power, ranging from 0.28 for CR1, 0.33 for CR45, 0.36 for CR3, to 0.66 for CR2. While the explanatory power of the CR2 model is substantially greater than the other models, it is also the most sensitive to perturbations of the variables as evidenced by the magnitude of the estimated coefficients for the model. There is also a concern with degrees of freedom for the CR2 and CR45 models, having less than half the number of observations as the other regional models. Thus, one tradeoff in regional versus national models is the restriction of regional coefficient equality in the national model versus lower degrees of freedom in the unrestricted regional models. To verify the meta-regression models estimated using classical OLS the weighted least squares (WLS) models could be estimated. One could use WLS with standard errors or sample size as the weights but this part of the analyses is not covered in the study.

Table 4.3: Optimized OLS Regression Models.

Variable	NATIONAL	CR1	CR2	CR3	CR45
CONSTANT	19.159*		26.541[a]	66.234*	10.044[a]
	(10.20)		(24.89)	(15.19)	(10.65)
METHOD	-17.598*			-34.381*	
	(6.81)			(12.17)	
DCCVM				27.066*	
				(13.63)	
OE	-7.468*				
	(3.82)				
RPSP	-38.170*	na	na		na
	(10.73)				
PAYCARD	-28.333	na	na		na
	(19.72)				
INDIVID		38.927*	52.653*		
		(14.40)	(14.21)		
RUM		63.278*		-28.392*	30.445*
		(29.500		(16.12)	(14.65)
SUBS	-20.277*			-33.481*	-18.851*
	(5.08)			(17.75)	(12.67)
MAIL			19.309		
			(12.01)		
PHONE	-18.626*				
	(4.24)				
LOGLIN					22.642**
					(11.84)
LOGLOG		24.305*			
		(12.11)			
VALUNIT	-5.820	-18.426*		-10.023*	
	(4.12)	(9.00)		(5.85)	
TREND	1.613*				
	(0.38)				
FSADMIN	-20.056*		-18.471	-14.595*	
	(3.929)		(11.36)	(8.74)	
R2	-6.581	na	na	-8.791	na
	(5.077)			(5.57)	
R5	-10.448	na	na	na	
	(6.96)				
R6	-14.218*	na	na	na	
	(4.55)				
R8	-8.756*	na	pc	na	na
	(3.74)				
R9	-7.124*	pc	na	na	na
	(3.83)				
R10	-14.980*	na	na	na	
	(8.50)				
LAKE	-16.803*	-30.097*			
	(6.61)	(15.26)			
RIVER	17.747*		-73.951*	40.462*	
	(8.05)		(26.40)	(26.84)	
FOREST			17.792*	-18.358*	
			(3.87)	(10.29)	

Table 4.3: Continued....

Variable	NATIONAL	CR1	CR2	CR3	CR45
PUBLIC	21.655*	29.652*	48.940*		pc
	(5.66)	(6.18)	(27.78)		
DEVELOP			-65.216*		
			(24.30)		
NUMACT				2.267*	
				(0.72)	
CAMP					107.59*
					(33.30)
PICNIC			-25.683*	-45.120	60.118*
			(12.30)	(15.82)	(33.37)
SISEE		78.925*	-50.590*		36.809*
		(16.56)	(27.36)		(10.05)
OFFRD	-7.898	na	na	na	19.803
	(5.08)				(10.05)
BIKE	-13.569	-58.772	-25.962*		na
	(7.63)	(19.11)	(15.92)		
DHSKI		na	na	40.033	
				(17.10)	
XSKI		14.005	na		na
		(8.20)			
SNOWMOB	-20.299*	na	na	20.026	na
	(9.74)			(12.38)	
BGHUNT	12.478*	21.70*	-48.391*	19.070*	34.536*
	(3.42)	(13.94)	(23.82)	(11.68)	(22.25)
WATFOWL	10.161*	14.479*	-57.781*		17.827*
	(4.25)	(8.24)	(23.49)		(8.57)
FISH	9.057*		-61.378		19.419*
	(4.12)		(25.07)		(7.81)
WLVIEW			-49.923		30.304*
			(23.42)		(15.94)
ROCKCL	39.738		na	28.222	na
	(12.59)			(13.5557)	
HORSE	-11.841	na	na	na	na
	(5.11)				
GENREC					24.721*
					(13.74)
Adjusted R^2	0.26	0.28	0.66	0.36	0.33
F-STAT	9.98*	8.89*	16.14*	10.08*	4.48*
	[25, 656]	[10, 195]	[14, 97]	[15, 222]	[12, 82]
N	682	206	112	238	95

*p<0.10; (all variables are p<=0.20).

a: intercept term in CR1 dropped (p>0.9) but CR2 (p=0.29) & CR45 (p=0.34) were retained.

na: no observation, pc: perfectly correlated.

Standard errors in parentheses (corrected for heteroskedasticicy & serial correlation using Newey-West version of White correction), except for F-stat where degrees of freedom are given in brackets.

Dependent variable is consumer surplus per person day.

In optimized meta-regression models only *BGHUNT* was significant across national and all regional models. Thus, direct comparison cannot be made between national and regional meta-models. For the most part, the signs of the methodology variables in the national model are consistent with past research results. *METHOD* is negative, meaning that SP models yields lower values than RP, which is consistent with the previous meta-analysis (Walsh et al., 1989, 1992) and the bulk of TCM-CVM comparison studies (Carson et al., 1996). This result is also consistent in CR3 model, where the variable is significant. *DCCVM* is positive in CR3, meaning that dichotomous choice CVM studies yield higher benefit estimates than other forms of CVM (Walsh et al., 1989, 1992; Brown et al., 1996). The elicitation methods such as *OE*, *PAYCARD* and *RPSP* yield relatively lower estimates than other forms of SP models in general, with the latter two methods being significant in the national model.

INDIVID travel cost models yields higher values, though *RUM* models revealed conflicting signs across CR1, CR3 and CR45, thus, the result should be treated with caution. *SUBS* is negative as expected, as the better job a model does of reflecting substitutes, the lower the benefit estimate will be (Rosenthal, 1987).

In terms of survey methodology used, *MAIL* is positive and retained only in CR2. The sign in *PHONE* surveys is negative implying this would yield lower estimate, which is consistent with prior recreation studies (Mannesto and Loomis, 1991).

In terms of functional form, *LOGLIN* and *LOGLOG* are positive and significant suggesting these forms yield higher benefit estimates than the other forms. *VALUNIT* is negative in three models and significant in two, suggesting that if the original study reported the value in units such as per trip or per season, then this tended to yield higher per day benefit estimates than those already reported on a per day basis (*VALUNIT* = 1 for per day measure). Therefore, either there may be a recall bias introduced when requesting values per trip, season, or year as compared to per day estimates, per day estimates understate the total trip or season value when aggregated, or the estimate of number of days per trip or season are understated. The *TREND* variable also shows that the effect is positive implying there has been an increase in benefit measures in real terms over time.

For the national, CR2 and CR3 models *FSADMIN* yields lower values. These USFS administered sites, however, are juxtaposed to sites designated to be of higher quality (e.g., National Parks, State Parks, and National Wildlife Refuges). Therefore, it is plausible that USFS sites would have somewhat lower recreation value than these other sites also and perhaps due to multiple uses like grazing in those sites, which detracts visitors from recreation.

It is also found that the coefficients on the FS regions variables *R2, R5, R6, R8, R9, R10* are negative, wherever retained, a finding similar to Walsh et al. (1989, 1992). Why this is the case is not clear.

LAKE has a negative sign in the national and CR1 models, showing that lake recreation has lower values than recreation activities in other sites. This makes more sense when we consider that reservoirs were coded as lakes in this analysis. River recreation (*RIVER*) yields higher values of recreation for the national model and CR3, but lower values for CR2. Recreation in forested areas (*FOREST*) yields higher values in CR2 but lower in CR3. But, the reason is not clear. *PUBLIC* lands provide higher valued recreation than private areas for the national, CR1 and CR2 models. One possibility is that private areas charge substantially more for access and onsite facilities and services than public areas, therefore, extracting much of the consumer surplus from visitors, while visitors to public areas are charged much lower prices and, therefore, retain much of their consumer surplus.

Areas with developed facilities, *DEVELOP*, have lower values in the CR2 model. Again, this may be due to such areas charging fees, whereas dispersed recreation areas often do not charge fees. It also may be that developed areas tend to be more crowded, such that congestion is being reflected in this variable as well (no variable for crowding was included as few studies reported such information). The number of recreation activities (*NUMACT*) available at a recreation site has a small, but positive influence on the estimated value.

The recreation activity variables found to be having mixed results. An interesting point to note is that the consumptive use of wildlife or fish activities (*BGHUNT*, *WATFOWL*, and *FISH*) all yield higher values except in CR2. Thus, besides providing a recreation experience, these activities also provide a tangible product that may be a symbolic trophy of the trip and/or consumed. This finding is also consistent with the Walsh et al. (1989, 1992) study. While big game hunting consistently has the most observations in the data set, fishing and wildlife viewing have nearly as many. The recreation activities having generally higher value than other recreation activities include, *CAMP*, *DHSKI*, *XSKI*, *ROCKCL*, and *GENREC*, where as the activities with lower values are, *BIKE* and *HORSE*. The activities such as *PICNIC*, *SISEE*, *OFFRD*, *SNOWMOB*, and *WLVIEW* yield mixed results across national and regional meta-models.

4.2.2. Insignificant Variables in the National Model

To aid analysts attempting to perform their own custom benefit transfer, the variables that are not significant in the national model are listed in Table 4.4. This shows that any differences between the original study and the policy application on these variables really have no effect on recreation values at least based on this research. Thus less than a perfect match on these variables would not bias the benefit transfer. It should be noted that the demographic variables referred in the Table 4.4 are state level average used as proxy since there were not enough information reported in the primary studies.

Table 4.4: Insignificant Variables in National Meta-Model

Category	Variables
Methodology Variable	*DCCVM, ITBID, ZONAL, INDIVID, RUM, TTIME, MAIL, INPERSON, LINLIN, LOGLIN, LOGLOG, RECQUAL*
Site specific variables	*R1, R3, R4, NATL, FOREST, DEVELOP, NUMACT*
Recreational activity variable	*CAMP, PICNIC, SWIM, SISEE, NONMTRBT, MTRBOAT, HIKE, DHSKI, XSKI, SMHUNT, WLVIEW, GENREC*
Demographic variables	*INCOME, AGE, EDU, POPUL, BLACK, HISPAN*

The demographic proxy variables were consistently not significant in the models. This is because, the state level aggregate measures for the population characteristics and income may not contain enough variability for our intended purposes. For illustration purpose the meta-regression output that includes *INCOME* is shown in Annex 4.6. Even with different functional forms *INCOME* has not been significant in the national model and also the model results did not change much with the change in the functional forms.

4.2.3. Pooled Model vs. Regional Models

It is also essential to determine whether we can pool all of the studies conducted in various regions of the United States and estimate a single model, or if the studies based on geographic location are structurally different in methodology and/or site characteristics. In the latter case, separate models for each region would have to be estimated. A Chow test was performed to evaluate structural equality of coefficients (Greene, 1993:349). The F statistic of 3.66 suggests at the 0.01 level that at least one of the regional intercept terms or slope coefficients differs from one of the others (Table 4.5). This means that there is not equality of coefficients and that separate models can be estimated for each census region.

Table 4.5: Chow Test for Pooling Data.

Hypothesis	F-stat	Result
H_0: α_r's = α_n's, and β_r's = β_n's H_1: at least one $\alpha_r \neq \alpha_n$, or at least one $\beta_r \neq \beta_n$	3.66	Reject H_0 at 0.01 level, do not pool data (Critical F-stat = 2.04)

4.3. Performance Assessment of Meta-model Benefit Transfer

There are different approaches to using existing information for benefit transfer when original research is not possible or not even warranted. First, study specific values, or an average of a subset of the available WTP estimates from the database (Loomis et al., 1999), can be transferred as appropriate. This is a benefit transfer based on point estimates. Second, similar to first approach, the simple average values per activity per region (Table 4.1) can be transferred to a policy site. Third, the national average value of an activity can be transferred (Table 4.1). Fourth, the meta-analysis predicted value (in-sample predicted values) for an activity in a region (as described by Loomis et al., 1999) can be transferred to the policy site. Fifth, the meta-regression equations (Table 4.3) can be adapted to specific policy site adjusting for the relevant variables. This approach is tested and discussed extensively in the out of sample testing and analyses (Chapter 5 and 6). Figure 4.1 provides a flow chart of the decision process to aid in determining which transfer approach is more appropriate given the circumstances. As Desvousges et al. (1998) stated, an important component in any benefit transfer is the analysts' judgment. Thus, the users will have to make their own judgment on which techniques would potentially better reflect the benefit value of the policy site in particular circumstances of the benefit transfer.

4.3.1. A Guide to Obtaining a Recreational Value

A conceptual framework on choosing an appropriate recreational valuation approach is developed, which provides a wide range of options in using the economic values in recreation decisions (Figure 4.1). With an identification that the recreation is a major use affected by the decision the first approach would be to search for the secondary data on visitor use and visitor residence (recorded zip code or county), on which a simple TCM using the USDA Forest Service RMTCM program (Rosenthal et al., 1986) can be performed to obtain the dollar values of recreation use. In absence of the secondary data the field users may either collect the original data or use the average value from the database (Table 4.1) for the particular activities in the region. Secondly, if the recreation is not a major use affected by the decision and the average value for the activities in the region is available in the database (Loomis et al., 1999) the field users may use the raw average or the re-computed average value.

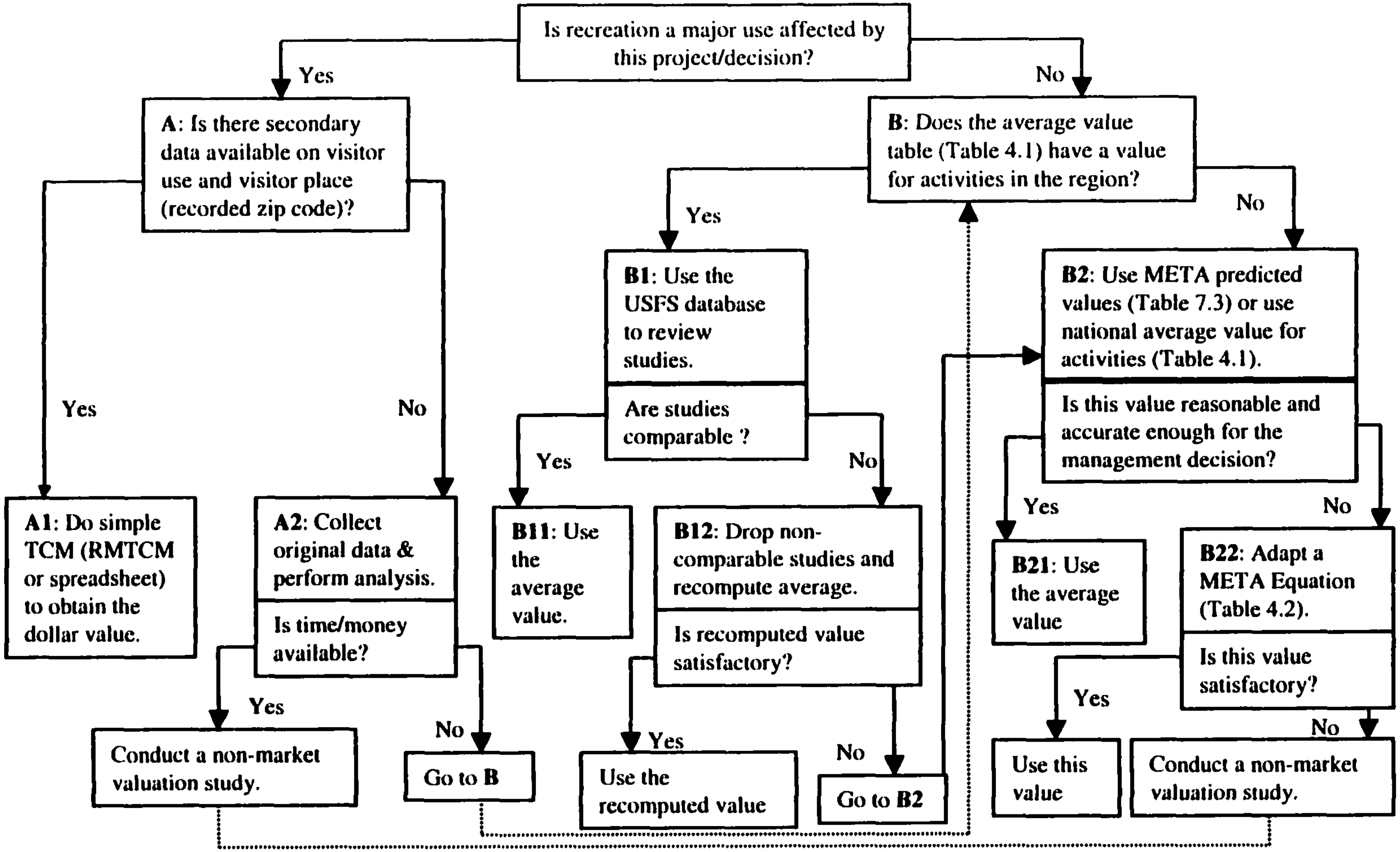

Figure 4.1: Users' Guide to Obtaining the Recreation Economic Values.

However, if the average value is not applicable, the national average value (Table 4.1), or the meta-predicted values as described in out of sample estimates (Chapter 5 & 6), or the value obtained from in-sample prediction using meta-equation (Loomis et al., 1999) would be the potential options. The meta-model predicted in-sample and out-of-sample estimation are illustrated in following sections.

4.3.2. In-Sample Meta-Model Predicted Average Value Transfer

One of the options for the benefit transfer from above meta-analysis could be to use an in-sample meta-predicted value as illustrated in following Table 4.5. The table uses national meta-regression model, and provides average consumer surplus by holding independent variables at their national mean values except for the relevant activity variables. The reason many values are same in Table 4.1 is that if there are no variables in the national meta equation that are specific to that activity or region the equation would predict same WTP values each time. In such a case the national equation calculates the same value for that activity and the region.

Table 4.5: Predicted Average Values Per Day from National Meta Equation in 1996 US Dollars.

Recreation activity	NATIONAL	CR1	CR2	CR3	CR45
Camping	36.10	42.29	41.50	42.29	41.75
Picnicking	36.10	42.29	41.50	42.29	41.75
Swimming	36.10	42.29	41.50	42.29	41.75
Sightseeing	36.10	42.29	41.50	42.29	41.75
Off-road driving	28.23	34.41	41.50	34.41	33.88
Float boating	36.10	42.29	41.50	42.29	41.75
Moter boating	36.10	42.29	41.50	42.29	41.75
Hiking/Backpacking	22.63	42.29	41.50	42.29	41.75
Biking	22.63	28.82	28.03	28.82	28.28
Downhill skiing	36.10	42.29	41.50	42.29	41.75
Cross country skiing	36.10	42.29	41.50	42.29	41.75
Snowmobiling	15.83	22.02	21.23	22.02	21.48
Big game hunting	45.47	51.66	50.86	51.66	51.12
Small game hunting	36.10	42.29	41.50	42.29	41.75
Waterfowl hunting	45.38	51.57	50.78	51.57	51.03
Fishing	43.59	49.78	48.99	49.78	49.24
Wildlife viewing	36.10	42.29	41.50	42.29	41.75
Horseback riding	24.28	30.47	29.67	30.47	29.93
Rock climbing	75.55	81.74	80.94	81.74	81.20
General recreation	36.10	42.29	41.50	42.29	41.75
Others	36.10	42.29	41.50	42.29	41.75

CR1, CR2, CR3 & CR45 are census regions. Census region 4 and 5 are combined as previously specified.

4.3.3. Out-of-Sample Meta-Model Predicted Value Transfer

This section provides an illustration on using meta-regression model for benefit transfer estimates as was used in out of sample testing of benefit transfer (Chapter 5 & 6). This illustration provides practical guidance for an application of meta-regression models for benefit transfer. As presented in out of sample testing, some of the variables has to be activated and some set equal to its mean in obtaining the meta-regression predicted WTP values for a particular site. Following illustration would serve as a guide for the benefit estimation for the policy site using meta-regression models (Table 4.6 and 4.7).

To illustrate the application of meta-analysis to benefit transfer, a policy site and a recreation activity was assumed (Table 4.6). In this way we can examine the process of using meta-regression in predicting WTP values for the activities and sites.

Table 4.6: Example: Variable Adjustments to Estimate the WTP value of a Big Game Hunting in Southern Idaho National Forest Land.

The variables in the relevant meta-regression models should be set equals to one, zero or mean as appropriate.

MTHOD, OE, RPSP, PAYCARD, SUBS, PHONE, VALUNIT, TREND:	All method variable set equal to their mean, since they are not specifically assumed in this illustration,
FSADMIN:	Set equal to one, as it is hunting in a national forest,
R2, R5, R6, R8, R9, R10:	These are RPA region variables, set equal to zero, since the area, Southern Idaho, is in R4,
LAKE, RIVER:	Set equal to zero, as they are not relevant in this illustration,
PUBLIC:	Set equal to one, since national forest is a public land,
BGHUNT:	Set equal to one, since big game hunting is a recreation activity performed in this site,
OFFRD, BIKE, SNOWMOB, WATFOWL, FISH, ROCKCL, HORSE:	These are other recreation activity variables not relevant to this illustration, therefore, set equal to zero.

The resulting meta-analysis equation is configured and used to estimate the value in Table 4.7 below.

The model predicts a value per day of US $32.71. This is comparable with a national average WTP value of US $38.63. Thus meta-equation predicted value is within 18% of the national average WTP value.

Table 4.7: Example: Meta Based Benefit Transfer Estimate for Big Game Hunting in the National Forest Land, Southern Idaho.

Variable	Coefficient	Mean/Level	WTP Estimated
C	19.16	1.00	19.16
BGHUNT	12.48	1.00	12.48
BIKE	-13.57	0.00	0.00
FISH	9.06	0.00	0.00
FSADMIN	-20.06	1.00	-20.06
HORSE	-11.84	0.00	0.00
LAKE	-16.80	0.00	0.00
METHOD	-17.60	0.64	-11.22
OE	-7.47	0.36	-2.66
OFFRD	-7.90	0.00	0.00
PAYCARD	-28.33	0.00	-0.08
PHONE	-18.63	0.51	-9.48
PUBLIC	21.65	1.00	21.65
R2	-6.58	0.00	0.00
R5	-10.45	0.00	0.00
R6	-14.22	0.00	0.00
R8	-8.76	0.00	0.00
R9	-7.12	0.00	0.00
R10	-14.98	0.00	0.00
RIVER	17.75	0.00	0.00
ROCKCL	39.74	0.00	0.00
SNOWMOB	-20.30	0.00	0.00
SPRP	-38.17	0.01	-0.28
SUBS	-20.28	0.26	-5.23
TREND	1.61	19.04	30.71
VALUNIT	-5.82	0.39	-2.28
WATFOWL	10.16	0.00	0.00
Estimated WTP	→	→	32.71

The convergent validity of meta-model in transfer of benefits is further analyzed in out of sample testing procedures. This analysis is discussed in greater details in the following chapters under out of sample testing and international benefit transfer analysis.

4.4. Summary

The benefit transfer in outdoor recreation has been practiced for decades and there is an apparent need of updating the recreational economic values to be transferred. Firstly, in this study, the efforts have been made to update the average WTP value for each recreational activity with recent research in outdoor recreation. Thus, this research adds on to the Walsh et al. (1992, 1988) and MacNair (1993) review of outdoor recreation economic values. Secondly, the meta-analysis of three outdoor recreation database is performed to identify and evaluate the systematic effects of the variables in the recreation economic values.

There are 21 recreational activities, all of which have point estimates, and most of them have average WTP value across U.S. census regions as well. These average WTP values are the most recent point estimates transferable in any policy site in the United States or Canada for estimating the economic value of outdoor recreation as deemed appropriate.

Meta-analysis of the dataset, on the other hand, revealed important relationships of the variables in the model and their effects on the recreation economic values. The Chow test result showed that the separate regional models can be estimated which is different from the national meta-model. Moreover, it was also revealed that census region four and five can be combined as there were not enough observation to estimate separate meta-models. Furthermore, the national model outperformed the regional models in terms of the applicability of the meta-models for recreation benefit transfer.

The meta-analysis provided important insights on some of the outdoor recreation variables. Most of the important variables of the meta-regression models revealed the results consistent with past literature with clear sign and significance.

However, there are some variables, the influence of which demonstrates no clear direction. More importantly, *TREND* variable shows the overall WTP of outdoor recreation is increasing over time. Also, there are some new recreation activities introduced in recent years, such as, rock climbing, horseback riding, biking, and snowmobiling; and some new methodologies, such as, random utility model, conjoint analysis and combined revealed and stated preference techniques (see also Rosenberger et al., 2000).

In the application of benefit transfer in outdoor recreation, several approaches are outlined in this chapter. Depending upon the users' requirement and judgments either point estimates or meta-model predicted values could be transferred. A detailed analysis of the applicability of the meta-models is presented in Part IV.

PART IV

TESTING BENEFIT TRANSFER MODELS

Part IV of this dissertation contains Chapter 5, 6 and 7. Chapter 5 deals with the out of sample tests of the meta-regression models estimated in previous chapter. In this chapter the meta-regression models predicted WTP values and original estimates of WTP from out of sample studies in the United States are compared using paired t-tests, Pearson's correlation and Chi-square tests, and analyzed whether the two WTP values converge. Therefore, these tests determine the validity of meta-regression models for benefit transfer. Similar testing procedure is applied in Chapter 6, international benefit transfer applications. In this case, the out of sample studies are collected from the countries around the world. Then, the original estimates of WTP from the out of sample studies are compared with meta-model predicted WTP values to test the convergence of those two series of estimates. Finally, Chapter 7 summarizes the dissertation and draws some specific conclusions.

CHAPTER 5

Testing Benefit Transfer: Out of Sample Approach

5.1. Introduction

One of the most crucial issues in the benefit transfer application is to obtain an accurate estimate of WTP that reflects the value of the recreation resources at a specific policy site. In an ideal situation the economic value of recreational resources would be obtained through the market or using original non-market valuation research. Benefit transfer as a technique is to supplement such "first-best" approaches when they are constrained by limited time, money or manpower, which should provide the estimates of the values as accurately as possible. In the context of benefit transfer with meta-analysis there is a need for testing the convergent validity of the meta-regression models predicted values while using the models for benefit transfer purposes. This testing is to determine whether the estimates obtained from study sites would converge into the benefit estimate that would have been obtained from an original study had there been a study in the policy site.

There are several tests developed that could be performed to examine the equality of the estimates or validity of the benefit transfer (Loomis, 1992, Loomis et al., 1995, Valdes, 1995, Downing & Ozuna, 1996, Kirchhoff et al. 1997, Kirchhoff, 1998, Bergland et al. 1999, Brouwer & Spaninks, 1999). Most tests have been done in the context of transferring point estimates or benefit function transfer. However, testing the transferability of the values estimated using meta-equation has been infrequent. An obvious testing procedure in case of benefit transfer using meta-regression models to examine the convergent validity is to perform in-sample tests (Loomis et al., 1999), where it was concluded that predictability of a national meta-model for recreation is far more precise that the individual geographic regional models. But, this test would be limited to the predictability of the models within the sampled studies used to estimate the model itself. This will, of course, limit the validity check of the models beyond the variability, which is not incorporated in the model. In reality, benefit transfer would mostly be employed in the context, which is external to the meta-model estimators. Thus, while in-sample tests are informative, a better test for benefit transfer would be to apply the meta-regression model to predict values not used in the meta-analysis regression. This is defined as out-of-sample testing in this study. It is particularly appropriate, since the rationale of using meta-analysis for benefit transfer is to estimate values for previously unstudied resources and sites.

As discussed above in greater detail regarding the potential application of meta-analysis in benefit transfer, the next step would be to test how well the meta-model would perform in predicting the benefit value compared to the one obtained in out of sample original studies. In this approach, the analysts will be able to incorporate the out of sample study specific variables in computing the benefit estimate. Out of sample studies are the studies, which were not included in the meta-analysis models estimated previously, therefore, can be treated as the representation of a policy site(s). While calculating predicted values using meta-regression models the policy site characteristics and methodological variables can be incorporated. Then, the predicted values are expected to be the representation of the actual WTP for the policy site/resource, i.e., an estimate of the original out of sample study values in this analysis. This approach has an advantage of including the effects of the variables of the out of sample studies. This is not often a possibility in the real world benefit transfer even with the information and analysis of some of the key variables of the policy sites as suggested in Boyle and Bergstrom (1992). Therefore, the convergent validity of meta-regression models could be examined to insure how well the meta-models predict the WTP values to be used in benefit transfer.

The first hypothesis is whether there is any statistically significant difference between the meta-estimates and the original study values. A paired t-test of the difference between meta-predicted values and original values obtained from out of sample studies will be performed for this analysis. Secondly, to test whether there is at least a positive relationship between the meta-predicted values and the original studies, a Pearson's correlation coefficient will be analyzed. Finally, it will be useful to check whether study by study predicted values from national and regional meta-regression model fall within the 95% confidence interval of the original study values, and whether the values occurring in the confidence interval is determined by the model used in predicting the transfer value. The Chi-square test would be used in this analysis process.

5.2. Data Collection and Coding

In order to perform this analysis the studies that became available beyond the meta-data gathering were acquired and coded the information therein into the spreadsheets (see Annex 5.1.). The typical literature obtained were 1996 U. S. Fish and Wildlife Service national survey, journal articles and reports (see Table 5.1). The sample design of the out of sample studies was not exhaustive as it was intended mainly to demonstrate the applicability of the meta-regression models and testing the predictability of the models in real world benefit transfer.

Table 5.1: Out of Sample Study Characteristics

Study	Valuation technique	Recreation good valued	No of estimate	Study site
Agri Enterprises Inc., 1998	TCM-ID	General recreation: reservoirs	1	Lower snake river, WA
Boyle et al., 1998	CVM-DC	Fish, Deer, Elk, Moose hunting & wildlife viewing,	25	National study, USA
Coupal et al., 1998	TCM-ID	Snow-mobiling	1	WY
Hackett, 1999	TCM-ZN	Wilderness	1	Trinity Alps, CA
Hansen et al., 1999	TCM-ZN	Pheasant hunting	2	Mid-west
Hilger, 1998	TCM-ZN	Hiking	2	Snow lake, Stuart/Colchuck, WA
Moeltner, 1998	TCM-ZN	Wilderness	1	Alpine lake, WA
Piper, 1998	TCM-ID	River recreation	1	Missouri and other 5 rivers, ND
Roach et al., 1999	CVM-DC	Rafting	1	Dead river, ME

Note: CVM-DC = Dichotomous Choice CVM; TCM-ID = Individual TCM; TCM-ZN = Zonal TCM. WA = Washington state, WY = Wyoming, CA = California, ND = North Dakota, ME = Maine.
A complete list of the studies is provided in Annex 5.2

5.3. Benefit Estimation

Based on the information obtained from the out of sample studies the recreation benefit estimates for the site specific resource use were computed using the meta-equations. In this process some of the variables of the meta-regression had to be set at the value specific to the site (e.g., activity, lake or stream, region) and when not available from the study they were set at meta-data set mean values. The following Table 5.2 provides the specific guidelines in estimating out of sample values using meta-regression models.

Table 5.2: Guidelines for Out-of-Sample Estimation.

This table includes only the variables from optimized national and regional meta-models, which considered to be used for benefit transfer.

Method variables:

METHOD, DCCVM, OE, RPSP, PAYCARD, RUM, INDIVIDUAL, SUBS, MAIL, PHONE, LOGLIN, LOGLOG, VALUINIT & TREND: These are method variables, set each of these variables equal to 1 when they applied to the out of sample study. Otherwise set equal to zero. For TREND code numeric value starting the year 1967=1, 1968=2, so on.

Site Variables:

FSADMIN: If the site is administered by the United States Forest Service, then set equal to 1.

R2, R5, R6, R8, R9 & R10: If the geographic region the policy site falls into North Idaho or Montana set R1 equal to one, if the policy site falls into Nevada, South Idaho or Utah, set R4 equal to one, if the site falls into Oregon or Washington set R6 equal to one and so on (see Annex 4.4).

LAKE, RIVER, FOREST, PUBLIC, DEVELOP: Should be set equal to one if they apply. Thus a study of boating at a Bureau of Reclamation Reservoir, for example, would have LAKE=1, RIVER=0, FOREST=0, PUBLIC=1, DEVELOP=1, as most Bureau of Reclamation lakes have developed facilities such as boat ramps, picnic areas, etc.

Activity Variables:

CAMP, PICNIC, SISEE, OFFRD, BIKE, DHSKI, XSKI, SNOWMOB, BGHUNT, WATFOWL, FISH, WLVIEW, ROCKCL, HORSE & GENREC: These are the recreation activity variable included independently in the meta-regression for each activity ranging from camping to general recreation (21 activities). In this case the same logic applies as with region. Only the relevant activity variable set equal to 1 and rest of all equal to zero.

NUMACT Set at the number of recreation activities typically participated in by a majority of visitors at the policy site. Only the most common activities, not every conceivable ones are counted. Count by general categories (i.e., non-motorized boating as one, rather than counting rafting, canoeing, kayaking as three activities).

In predicting the out of sample estimates all relevant meta-regression models, i.e., national and regional models, were used depending on their relevance to the particular out of sample study. If the estimates were given for several regions, all applicable regional models were used. Thus, there are predicted values from the national model as well as relevant regional models for the same original WTP estimate of a study. In some cases there are predicted values for the multiple regions, which is because the out of sample study estimates are given for multiple states that fall under different census regions. In that case all relevant regional models are applied. The details of the benefit estimates predicted by the meta-regression models for the out of sample studies, the original estimates of the studies, and the 95% confidence interval of the original values of the studies are presented in the Annex 5.3.

The values from the original studies were computed in terms of the WTP per day if they were expressed in terms of WTP per trip. In some cases further information had to be sought to calculate per day WTP values. All original study values were adjusted to 1996 dollars using implicit price deflator.

5.4. Out of Sample Testing Procedure

5.4.1. Paired t-test

As discussed earlier in this chapter there are two estimates of values, i.e., the original WTP value obtained from the out of sample studies and predicted benefit values given by meta-regression models (national and regional). The meta-predicted values were computed incorporating the policy site (where out of sample studies were conducted) explanatory variables. Then, the testable proposition is whether the meta-predicted values are same as the original WTP values given in the out of sample studies. This can be expressed as follows,

$$\overline{WTP}^{meta} = \overline{WTP}^{original} \tag{5.1}$$

This proposition can be tested using paired t-test for equality of means of the two different estimates of WTP values (Sirkin, 1995). Valdes (1995) used similar test statistics in his paired t-test for benefit transfer analysis of CVM studies in recreation sports fishing. More specifically, the hypotheses of the convergent validity of the meta-predicted values using national or regional meta-models and the original study values obtained from the out of sample studies in the USA would be as follows,

Hypothesis for national meta-model predicted values:

$$H_o: \quad \overline{WTP}_t^{mn} - \overline{WTP}_p^{ou} = 0 \tag{5.2}$$

$$H_1: \quad \overline{WTP}_t^{mn} - \overline{WTP}_p^{ou} \neq 0$$

Hypothesis for regional meta-model predicted values:

$$H_o: \quad \overline{WTP}_t^{mr} - \overline{WTP}_p^{ou} = 0 \tag{5.3}$$

$$H_1: \quad \overline{WTP}_i^{mr} - \overline{WTP}_p^{ou} \neq 0$$

where,

$\overline{WTP}$ = mean willingness to pay estimates,

m = meta-model predicted value

n = national meta-model used in prediction

r = 1, …, 5; regional meta-model used in prediction

o = original WTP value obtained from out of sample studies

u = out of sample studies conducted in the United States

i = 1… t; number of meta-predicted observations

p = 1…t, number of original out of sample observations, and i = p.

A paired t-test is distinguished from the standard two-sample t-test, which essentially testing for equality of two means from two independent samples. In two-sample t-test the analyst would consider the two samples variances either equal or unequal. But, in paired t-test the two dependent samples drawn from same population are considered. The interest here is to predict WTP value for the same sample.

"While we call this test a two-sample t-test for dependent samples (or matched pairs), actually the test is a one-sample t-test applied to the difference in each pair of scores" (Sirkin, 1995).

This is also referred as paired difference t-test. Since this test is for the difference between predicted and original WTP values, the hypothesis can be reformulated as follows,

$$H_o: \quad \mu_D = 0 \tag{5.4}$$

$$H_1: \quad \mu_D \neq 0$$

Test Statistics for paired t-test of two dependent samples;

$$t = \frac{(\overline{D} - \mu_D)}{S_D / \sqrt{n_p - 1}}, \quad \text{with} \quad df = n_p - 1 \tag{5.5}$$

where,

D = difference between each pair of predicted and original WTP value

$\overline{D}$ = mean of the sample difference scores

n_p = number of matched pairs of scores in the sample

S_D = sample standard deviation of the difference scores

μ_D = the mean of the difference WTP values for all possible pairs in the population.

Sample standard deviation of the difference in WTP values is represented by,

$$S_D = \sqrt{(D - \overline{D})^2 / n} \tag{5.6}$$

Statistical significance of t-value at certain confidence level would indicate rejection of the null hypothesis, which would demonstrate that the two WTP values are essentially different. Of course, we want to test whether the two sets of values are same. Thus, the convergent validity of the meta-models requires the null hypothesis to be accepted.

5.4.2. Correlation Analysis

In addition to the paired t-test, correlation coefficient analysis would at least show the direction and degree of association between two estimates of values and the statistical significance to such a relationship. Thus, the Pearson's correlation coefficient analysis would be performed to examine the relationships between meta-predicted WTP values and the original study values.

The Pearson's correlation coefficient (r) between predicted and original WTP values could be evaluated using following hypothesis.

H_o: r = 0 (5.7)

H_1: r ≠ 0

The significance of the correlation coefficient could be directly checked from the given table comparing critical r for specific degrees of freedom and calculated correlation coefficient (Mason and Lind, 1993).

Test statistics for Pearson correlation coefficient is given by,

$$r = \frac{p(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{[p(\Sigma X^2) - (\Sigma X)^2][p(\Sigma Y^2) - (\Sigma Y)^2]}} \tag{5.8}$$

where,

r = Perason's correlation coeffcient,

X = meta-predicted WTP based on national or regional meta-models,

Y = original WTP values from the studies,

p = number of observations in original studies,

i = number of observations in meta-predicted WTP, and i = p.

H_o will be rejected if the computed correlation coefficient is greater than the critical one at chosen confidence level, which would imply that there is significant correlation between the predicted and original WTP values. A significant correlation implies some level of convergent validity between the two estimates.

5.4.3. Confidence Interval Analysis

Another way of evaluating the reliability of predicted WTP values is to observe whether the each predicted value remain within certain confidence interval, say, the 95% confidence interval (CI), constructed from the original study. This would potentially demonstrate the possibility of predicted values reflecting the original WTP values of the policy site at least with certain error. But, such an observation of the convergent validity of individual predicted values would not prove any indication of whether the national or regional meta-models is better at predicting the WTP values. Thus, the question of whether there is any systematic association between the predicted WTP values falling within or beyond the 95% CI and the values being predicted using national or regional meta-models can be answered using Chi-squire test.

Formally, the hypothesis can be formulated as follows,

$$H_o: \chi^2 = 0 \tag{5.9}$$

$$H_a: \chi^2 \neq 0$$

Chi-square test-statistics:

$$\chi^2 = \sum (f_o - f_e)^2 / f_e \qquad \text{with df} = (r-1)(c-1) \tag{5.10}$$

where,

f_o = observed frequency of predicted values falling in/out of 95% CI,

f_e = expected frequency, given for each cell by,

(row marginal * column marginal)/grand total.

r = number of rows

c = number of columns

Moreover, for chi-square degrees of freedom not more than one, Yates' correction for continuity should be made (Sirkin, 1995). Then, the formula for chi-square statistics needs to be modified as,

$$\chi^2 = \sum (|f_o - f_e| - 0.5)^2 / f_e , \qquad \text{with df} = (r-1)(c-1) \qquad (5.11)$$

The null hypothesis is, therefore, two sets of values are independent, i.e., there is no relationship between values being predicted using national/regional meta-models and their being in/out of the confidence interval. This will particularly confirm whether there is a difference in predicted values using national and regional meta-models indicating one of the models being a better predictor. The calculated Chi-square value greater than critical value would imply rejection of H_0. This would then prove significant statistical dependence of the two sets of values, i.e., depending on which of the national or regional models being used in predicting WTP values, the values falling within or out of the confidence interval is determined.

5.5. Test Results and Discussion

5.5.1. Paired t-test

In convergent validity test procedure for out of sample studies the predictability of two meta-regression models were evaluated. The national meta-model was used for computing the out of sample predicted WTP in the first test, where as the regional meta-models were used for the second. Moreover, due to the small sample of predicted WTP values of each of four regional meta-models, all the regional meta-model predicted values were aggregated for the test purpose and performed paired t-test against the original out of sample estimates. The difference in the number of observations between the national and regional meta-models was due to the multiple predicted values of some of the out of sample studies using different regional models. The test result is presented in Table 5.4. The analysis was performed using EXCEL software.

Table 5.4: Paired t-test Results Using National and Regional Meta-Regression Models

	National Meta		*Regional Meta*	
	Predicted	Original	Predicted	Original
Mean	$44.81	$28.10	$40.09	$26.94
Variance	210.59	462.18	253.35	397.10
t-stat	5.02**		3.19**	
Pearson Correlation Coefficient	0.5982**		0.0895	
Observations	28	28	35	35

** = t-stat is significant at p<0.01 significance level.

The statistical test results presented in Table 5.4 show that the t-stats are significant at probability value of 0.01 or lower (p<01) in both national and regional models implying the H_o can not be accepted. This demonstrates the null hypothesis of the difference between the meta-predicted WTP values and the WTP estimates from original out of sample estimates are statistically zero is rejected. Therefore, the paired t-test shows that the meta-regression models do not have convergent validity, i.e., the meta-predicted WTP values essentially do not converges to the original out of sample estimates. With this result, we determine that meta-regression models can not accurately predict the WTP value that could be used for benefit transfer.

Moreover, for the descriptive analysis it is evident that the mean WTP of the meta-predicted values are higher in both national as well as regional models compared to the actual benefit estimates of the original studies. This would imply that meta-regression models would potentially over-predict the WTP for benefit transfer. The Table 6.3 shows that the predicted WTP from national model is 59.5 percent greater that the actual and that from regional models is 48.8 percent higher. In such a situation benefit transfer of the meta-predicted WTP value would be biased. A calibration technique in benefit transfer has been suggested to correct the biasedness (Feather & Hellerstein, 1997; Smith et al, 1999).

5.5.2. Pearson's Correlation

The test statistics based on Pearson's correlation coefficient show a positive correlation between predicted WTP and the original study values. In case of the predicted values from national meta-models correlation coefficient of 0.598 is significant ($p<.01$), which indicates that the predicted and actual WTP estimates are significantly correlated and there is a tendency of predicting higher WTP value for the site/resource where original WTP is larger. Where as, for regional meta-models, the correlation coefficient is not strong. The correlation coefficient of 0.089 is insignificant even at significance level 0.1. This indicates that even if a weakly positive correlation exists there is no significant correlation between the predicted WTP value using regional meta-models and the value obtained from original studies.

5.5.3. Confidence Interval

From confidence interval analysis it is revealed that for the national model 7 out of 25 (25%) meta-predicted values occur within the 95% confidence interval of the original out of sample estimates. In case of regional models, only 6 out of 32 values (18.75%) fall within the interval. This also indicates that regional models may have lower predictability compared to the national meta-models.

Table 5.5: Number of Meta-Predicted WTP Values Falling In/Out of the Confidence Interval.

	Values within CI	Values out of CI	Sub-total
National meta-model	7	18	25
Regional meta-model	6	26	32
Sub-total	13	44	57

To test the hypothesis of independence of the two set of values chi-squire statistics was calculated. This analysis was mainly to determine whether the meta-predicted values occurring in the confidence interval depends on the values being generated from national vs regional meta-models. In the process of chi-squire analysis we had to make adjustment for Yates' correction for continuity as the chi-square degrees of freedom was not more than one in our data set (eq 5.9). With this correction, the calculated chi-square value of 9.43 was obtained, which was higher than the critical chi-square value of 3.84 for one degree of freedom at ($p< 0.05$). Thus, we reject the null hypothesis of no relationship. This demonstrates that the use of national model yields a greater number of correct predictions than the regional model. With reference to the weak positive correlation between meta-predicted values using regional models and original study values, observed in previous section, it is possible to conclude that the national model would have been a better predictor.

5.6. Summary

Out of sample convergent validity tests for benefit transfer demonstrate that the meta-regression model yields statistically higher WTP estimates than the original studies. This was the basic result of the paired t-test on the difference between the meta-predicted WTP and the original study values. However, the evaluation of the Pearson's correlation coefficient between the predicted and original values showed two different results. There was a significant positive correlation between predicted values using national meta-model and original study, but very weak correlation between the predicted values from regional meta-models and the original study. At least in the former case, the national meta-regression predicted higher values for the bigger original estimates and vise versa. The chi-square test for the independence of two sets of values, i.e, whether the predicted values occur in the confidence interval constructed from the original study values depend on which model (national or regional) applied to predict the values, was performed. The rejection of the null hypothesis of no association, showed that there was a systematic relationship between model used in predicting the WTP value and its being occurred in the confidence interval. This indicated that the national meta-model could be a better predictor. From this result and the correlation coefficient analysis, we could conclude that national meta-model should be more useful compared to the regional meta-regression models for benefit transfer purpose.

In general meta-models would seemingly inflate the WTP estimates potentially providing upper-bound of the benefit estimates for policy site. Therefore, in principle an analyst or user would be able to calibrate the meta-predicted values to be employed in the real world benefit transfer. At least, the out of sample convergent validity test performed above for national meta-model indicates that the meta-predicted WTP estimates could be reduced by about 60 percent to apply the benefit transfer value in the policy site. This may allow closer prediction of accurate WTP values for the policy site than the unadjusted values generated from national meta-regression model.

CHAPTER 6

Testing International Benefit Transfer

6.1. Introduction

The research on recreational benefit transfer in the international context has been infrequent in the current literature. McConnel (1992) indicated some prospect of this approach mainly in the interest of international institutions, such as, the World Bank and the Inter-American Development Bank, which have been considering the non-market effect of their development projects in developing countries. In that case, international benefit transfer could be potentially a useful tool for their project analysis. Moreover, many such international institutions in business and development fields may have been approaching some sort of economic value transfer for evaluation of their projects. Also, there is a strong possibility that the economic value transfer would have undertaken from developed to developing countries. Desvousges et al (1998) mentioned the development and application of BCA in the context of developing countries, which needs to be assisted by benefit transfer in many cases. Since the developing countries are less able to afford new original studies and often do not have the infrastructure for primary research, an approach of transferring benefits would be often useful.

In this chapter the analysis has been performed to test the convergent validity of meta-models in the context of benefit transfer from the United States to the other counties, defined as the rest of the world (ROW). This analysis involves testing whether meta-model predicted values are equivalent to the original study values in the ROW sites.

There has not been any established method or model developed for such transfer process at least in capturing non-market values of recreational resources. Though, international trade theories and models would provide a mechanism to deal with the problem of adjusting the benefit values to exchange rate or more specifically the purchasing power differentials among countries, the basic question of whether the benefit estimates could be transferred between or across countries is yet to be resolved.

The recent literature on international benefit transfer indicate that there are some apparent need for this in various fields and have been several researches and evaluations to this end. Hu (1995) studied possibility of benefit transfer to value air quality in Beijing, China using direct method of transferring the benefit estimates of the eastern United States with some adjustment for income and demographic differentials between China and the United States. Hu computed the benefit values adjusted for the income elasticity and the purchasing power parity (PPP) factor. He also compared the estimated benefit value with the original WTP value obtained from a pilot CVM study of Beijing households and found that benefit transfer served as a lower bound estimates. Sumaiku (1998) also studied an application of benefit transfer for development of geothermal energy in Indonesia. In this study the author analyzed the possibility of transferring benefit estimates from Denver-Chicago, USA and Hualien, Taiwan to evaluate the health impact of air pollution in Dieng, Indonesia, and found that the benefit transfer from Taiwan to Indonesia was preferable. Alberini et al. (1996) & Alberini & Krupnick (1997) tested for the benefit transfer potential to estimate the WTP to avoid a restricted activity day of head cold (epidemiological study) in Taiwan. They estimated the benefit value for Taiwan directly from the two studies done in the USA with an adjustment for median income ratio and compared the predicted value with the original estimate of the Taiwan study, and found that the predicted values were within the 95% confidence interval. The authors concluded that a simple approach to benefit transfer worked fairly well in their study. A similar study was also done by Chestnut et al. (1997) on estimation of health benefit in Bangkok, Thailand. In this case, the authors compared the benefit estimates of the Bangkok study with the selected studies in the USA indicating the possibility of direct transfer of benefits.

Moreover, Ready et al. (1999) studied application of benefit transfer across the countries in Europe on health valuation. The authors estimated pooled as well as individual models for each country and evaluated the benefits between the transferred estimates and own-country estimates, and concluded that the researcher would have to expect certain errors but acceptance is up to the user.

Interestingly, most of the above international benefit transfer endeavors appeared to be in the human health sector and found to be using either a direct transfer or benefit function transfer approaches. Since there has been relatively better understanding and estimates on the health effects of the environmental problems, particularly air pollution, the benefit transfer techniques are being applied in this field beyond the national borders. However, benefit transfer application in recreation would be more challenging and could be important since there has been increasing demand for recreation and tourism in the international level.

International benefit transfer is one of the applications where meta-analysis models could be used. As briefly discussed above, all of the benefit transfer efforts have been devoted to the benefit transfer directly from a study site/country, say the United States, to an another policy site/country, China, for example. However, an international benefit transfer using meta-model is a relatively new approach.

Furthermore, there are certain additional issues beyond the typical problems the benefit transfer within a country could possibly have. Those issues could even be different in case of the transfer across developed countries, and between the developed and developing countries. Krupnick (1993) discussed the issues regarding international benefit transfer in the context of valuing the environmental damage resulting from electricity generation projects. He pointed out several important issues related to the socioeconomic differences between the developed countries where study values came from, and the developing countries where the transfer took place.

Among others, the differences in the economic as well as socio-cultural factors across countries would be important in this context. These factors become crucial even in a benefit transfer within a country as the transfer takes place in a different site with diverse features. Morrison et al. (1998) tested the possibility of benefit transfer across sites as well as across population (rural-urban) and concluded that the transfer across site is less problematic than across population. Though, the task could be daunting, this is the area where meta-analysis would contribute for a more appropriate transfer of benefits.

6.2. Data Collection and Coding

Though the whole study of meta-analysis and benefit transfer is based on secondary literature the data gathering process and its accessibility has been different in every topic that has been covered in this dissertation. More specifically, the data on non-market valuation of recreational resources in the countries around the world are even more difficult to access and retrieve. Most of the databases developed and accessible through a library are limited to a specific country or region. Furthermore, the information regarding the studies on recreation valuation in developing countries are rare and even harder to access. For this study, the countries other than the United States are considered as rest of the world, and the data were collected from all the countries as much as available and accessible.

As has been done in the previous chapters, the economics related databases were extensively used in the data gathering process. To this end, the reference list of the studies conducted by European Commission and EVRI (1999) was an important source of information. Similarly, the literature, such as, the journal articles, book chapters, theses/dissertations and the full articles available in the internet were of immense value. More importantly, the chain of references provided in each article has been highly helpful to further track down the relevant studies. Therefore, the sampling process of this out of sample study was though extensive might not be exhaustive. The list of publications used for international benefit transfer analysis is presented in the Table 6.1.

Table 6.1: Characteristics of the Original Study Used in International Benefit Transfer.

Study	Country	Valuation Technique	Recreation Goods Valued	Estimates	Study Site
Marangon, F. & P. Rosato., 1998	Italy	CVM-IB	Ungulates, hares, birds hunting	3	Lentiai, Limana, Livinallongo, Parco delle Prealpi Carnicle
Signorello, G., 1998	Italy	CVM-DC	Bird watching	2	Vendicari wetland
Bazzani, G. M., 1998	Italy	CVM-OE	Roe deer, gorcello grouses, hare hunting	2	Tonezza del Cimone alpine reserve, Vicenza
Casini, L. and S. Romano, 1998	Italy	CVM-DC	Big and small game hunting	8	Florence
Romano et al, 1998	Italy	TCM-RUM	Outdoor recreation	1	National-Italy
Dixon et al, 1995	Madagascar	CVM-DC	Outdoor recreation	2	Mantadia national park
Rollins, K., 1995	Canada	CVM-DC	Camping & cannoing	6	Ontario parks
Garrod, G. D. & K. G. Willis, 1996	UK	CVM-OE	Instream flow, fishing, viewing	2	River Darent
Shultz et al, 1998	Costa Rica	CVM-DC	Gen recreation, NP visits	4	Poas Volcano, Manual Antonio park
Menkhaus, S. & D. J. Lober, 1996	Costa Rica	TCM-ID	Camping, sight seeing, horseback riding	1	Monteverde Cloud Forest Reserve
Chase et al, 1998	Costa Rica	CBM	Gen rec, NP visits	3	Poas Volcano, Irazu, Manual Antonio park
Day, Brett, 1999	South Africa	TCM-RUM	Wildlife viewing, Sightseeing, Camping	4	Kwazulu-Natal: Hluhluwe
Lee, H & Chun H., 1999	South Korea	CVM-DC	Wild bear, water deer hunting	1	North & South Kyongsong Province
Lee et al, 1998	South Korea	CVM-DC	Wildlife viewing	2	Mt. Minju
Tyrvainen L & Vaananen, H., 1998	Finland	CVM-IB	Hiking, skiing	6	Repokallio, Linnunlahti, Lykynlampi
Leon, C. J., 1997	Spain	CVM-OE	Sight see, camp, hike	2	Gran Canaria (Canary Island)
Beal, D. J., 1995	Australia	TCM-ZN	Camping & viewing	1	Carnarvon Gorge NP
Boxall, et al, 1999	Canada	TCM-ZN	Canoeing, fishing, hunting, moterboating, camping	4	Nopiming, Atikaka, Whiteschell, Woodland Caribou
McFarlane, B. L. & P.C. Boxall, 1998	Canada	TCM-ZN	Camping	1	Foothills Model Forest
Maille P. & R. Mendelsohn, 1993	Madagascar	TCM-ID	Wildlife viewing	2	Beza Mahafaly Special Reserve
Tobias, D. & R. Mendelsohn, 1991	Costa Rica	TCM-ZN	Camping, sightseeing, horseback riding	1	Monteverde Cloud Forest Reserve
Moran, D., 1994	Kenya	CVM-DC	Wildlife viewing, Offroad driving, sightseeing	1	Kenya NP & Reserve

Table 6.1: Continued ....

Study	Country	Valuation Technique	Recreation Goods Valued	Estimates	Study Site
Willis, K. G. & G. D. Garrod, 1991	UK	TCM-ZN	Outdoor recreation	6	Brecon, Cuchan, Chesire, Lorne, New Forest, Ruthin
Moons, E., 1999	Belgium	TCM-ID	Hiking, biking	2	Heverleebos & Meerdaawoud
Newsome, M. A., 1997	Ecuador	TCM-RUM	Ecotourism: sightseeing, mountain climbing, hiking, bird watching	2	Galapagos, Amazon
Mercer et al, 1995	Madagascar	TCM-ID	Ecotourism: sightseeing, wildlife viewing	2	Mantadea national park
Kerr, G. N., 1996	New Zealand	CVM-PC	Big game hunting, fishing, trekking	6	Greenstone & Caples
Garrod, G. D. & K. G. Willis, 1997	Malaysia	CVM-OE/ TCM-ID	Forest recrea: hiking, camping	6	Jeram Lanang, Telok Bahang, Gunung Pulai, Jeram Lanang, Telok Bahang, Gunung Pulai

Note: CVM-OE = Open ended CVM; CVM-DC = Dichotomous choice CVM; CVM-IB = Iterative bidding CVM; CVM-PC = Payment card CVM; TCM-ZN = Zonal TCM; TCM-ID = Individual TCM; TCM-RUM = Random Utility Model TCM; CBM = Contingent behavior method.

A complete list of the studies is provided in Annex 6.1.

Once the original studies were retrieved, they were reviewed and coded in a standard worksheet (see Annex 5.1) corresponding to the national meta-model estimated previously. In order to make the original data across studies and in the meta-model consistent, WTP values reported in the original study had to be adjusted to WTP per day value, wherever they were reported for annual, seasonal or trip value. Moreover, the WTP values were also adjusted to the 1996 US dollars to account for the inflation. Since many WTP values were reported in terms of their domestic currencies, the purchasing power parity (PPP) conversion factors were used to make the data more comparable. The World Bank, World Development Indicators, CD-ROM (World Bank, 1999) defines that PPP conversion factors are based on price and expenditure surveys conducted by the International Comparison Program. Thus, the PPP conversion factors represent, "the number of units of a country's currency required to buy the same amount of goods and services in the domestic market as a dollar would buy in the United States" (World Bank, 1999:5.6:Definitions). The PPP adjustment to the WTP reported in the original studies is important since the market exchange rates would only account for the goods and services traded in the market. A similar adjustment in the WTP values made by Hu (1995).

Moreover, it is also important to understand that many studies conducted in ROW were measuring WTP for foreign visitors (mainly from the developed countries), the values were reported in the US dollars, and there was no complete information on the exchange rates used in those studies. Thus, the reported dollar values were directly recorded.

Among the retrieved studies for the data collection and coding, more than 30% studies were either irrelevant or did not have enough information. In case of completing some of the key information that were missing in the publications an effort has been made to contact the authors of the particular study through email, but only one out of ten cases was successful. In those cases some minor computations were made using the information from the relevant studies, or the information from other relevant publications were sought to fill in a missing link.

6.3. Benefit Estimation

With regard to the analysis of international benefit transfer applications, the national meta-model of this study was used. The regional models in this context would have limited applicability as they were being less robust and more area specific. In estimating the transferable benefits using national meta-model some specific guidelines were employed. Specifically, the United States Forest Service RPA region variables of the model were not directly relevant in this estimation and were normalized into their mean in the international benefit transfer estimations. Moreover, the other activity, site and methodological variables were activated in the benefit estimation depending upon their relevance to the specific sample study (see Table 6.2).

Table 6.2 : Guidelines for International Benefit Estimation.

This includes only the variables from the optimized national meta-model, which is used for the analysis of international benefit transfer.

Method variables:

METHOD, OE, RPSP, PAYCARD, SUBS, PHONE, VALUINIT & TREND: These are method variables, set each of these variables equal to 1 when they apply in the out of sample study. Otherwise set equal to zero. For TREND, code numeric value starting year 1967=1, 1968=2, so on.

Site Variables:

FAMGMT: If the site is managed by forestry agency (central, state or local Government), then this variable is set equal to 1. Otherwise set equal to zero. This variable is equivalent to *FSADMIN* in meta-model estimation.

R2, R5, R6, R8, R9 & R10: Set all of the RPA regional variables equal to their mean since they have no specific relevance to the international out of sample studies.

LAKE, RIVER, PUBLIC: Set these variables equal to one if they apply. Otherwise set equal to zero.

Activity Variables:

BIGHUNT, BIKE, FISH, HORSE, OFFRD, ROCKCL, SNOWMOB, WATFOWL: These are the recreation activity variables included independently in the meta-regression for each activity ranging from camping to general recreation. Only the relevant activity variable set equal to 1 and rest are set equal to zero.

The meta-model predicted WTP values and original study values are presented in Annex 6.2 and 6.3.

6.4. Methodology and Testing Procedure

6.4.1. Paired t-test

As discussed in greater details in the previous chapter the paired t-tests were performed to analyze whether the two WTP values, i.e., original WTP value obtained from the ROW studies and the benefit values predicted by meta-regression model, were statistically same. The meta-predicted values were computed using national meta-model estimated in the Chapter 4 (Table 4.3). The detailed procedure of the estimation has been discussed in earlier section of this chapter. To test whether the two categories of values converge, the following proposition was formulated,

$$H_o: \quad \overline{WTP}_e^{mn} - \overline{WTP}_q^{ow} = 0 \qquad (6.1)$$

$$H_1: \quad \overline{WTP}_e^{mn} - \overline{WTP}_q^{ow} \neq 0$$

Where,

$\overline{WTP}$ = mean willingness to pay

m = meta-equation predicted value

n = national meta-model used

o = original study value

w = 1, …, 15; study from ROW

e = 1, …, k; no of observation of predicted WTP values

q = 1, …, k; no of observation of original WTP values from ROW

and q = e.

A paired t-test on the predicted vs the original recreation values would determine whether to accept or reject the H_o. Accepting the H_o would imply that there is a convergence between the two sets of values and would demonstrate the validity of benefit transfer from a study site, the United States in this case, to the policy site, the rest of the world. More formally the above proposition can be addressed as the following testable hypothesis,

$$H_o: \quad \mu_D = 0 \tag{6.2}$$

$$H_1: \quad \mu_D \neq 0$$

Test statistics for paired t-test of two dependent samples;

$$t = \frac{(\overline{D} - \mu_D)}{S_D / \sqrt{n_p - 1}}, \quad \text{with} \quad df = n_p - 1 \tag{6.3}$$

where,

D = difference between each pair of predicted and original WTP values

$\overline{D}$ = mean of the sample difference scores

n_p = number of matched pairs of scores in the sample

S_D = sample standard deviation of the difference scores

μ_D = the mean of the difference of the WTP values for all possible pairs in the population.

Sample standard deviation of the difference in WTP values is represented by,

$$S_D = \sqrt{(D - \overline{D})^2 / n} \tag{6.4}$$

Statistical significance of t-value at certain confidence level would indicate the rejection of the null hypothesis, which would then imply that the meta-predicted values and the original WTP values of international studies are statistically different.

6.4.2. Correlation Analysis

The correlation test between meta-predicted WTP values and original study values from ROW is another way to evaluate the statistical convergence of those two sets of values. The correlation coefficient analysis would show the direction and degree of association between the two sets of values and the statistical significance to such a relationship. Thus, the Pearson's correlation coefficient analysis was performed to examine the relationships between meta-predicted WTP values and the original study values obtained from the ROW studies. The Pearson's correlation coefficient (r) between predicted and original WTP values could be evaluated under following hypothesis,

$$H_o: r = 0 \qquad (6.7)$$

$$H_1: r \neq 0$$

The significance of the correlation coefficient could be directly checked from the given table comparing critical r for specific degrees of freedom and calculated correlation coefficient (Mason and Lind, 1993).

Test statistics for Pearson correlation coefficient is given by,

$$r = \frac{q(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{[q(\Sigma X^2) - (\Sigma X)^2][q(\Sigma Y^2) - (\Sigma Y)^2]}} \tag{6.8}$$

where,

r = Perason's correlation coeffcient,

X = meta-predicted WTP values based on national meta-model,

Y = original WTP values from the ROW studies,

q = number of observations of ROW original studies

e = number of observations of meta-predicted WTP values, and q = e.

H_o will be rejected if computed correlation coefficient is greater than the critical one at chosen confidence level, which would imply that there is a statistically significant correlation between the predicted and original WTP values. A significant correlation implies there is a strong association between the two estimates.

6.4.3. Treatment of the Benefit Values of the Original Studies

To compare the original study WTP values to the meta-predicted ones, the values obtained from international studies were adjusted using the PPP conversion factors as discussed in previous section.

The PPP adjustment on the original WTP values obtained from ROW studies were based on the following expression:

$$WTP_q^{ow} = WTP_s^{ow}(PPP_w) \tag{6.5}$$

where,

o = original study value

w = 1, ..., 15; study from ROW

s = 1, ..., k; no of observations of original WTP values before adjustment

q = 1, ..., k; no of observations of original WTP values adjusted to PPP

Moreover, in the process it was suspected that a few of the observations in the dataset had disproportionate impact on the result. Therefore, the data were analyzed with different treatments to diagnose the effects. The treatment A represents the basic model with the PPP adjustment in original WTP, where all the samples were included in the paired t-test. In case of treatment B the high values of original WTP (greater than two-standard deviations from their mean) were excluded, whereas, in treatment C the out-of-sample studies associated with high WTP value were removed from the analysis, which included some of the values that were within the two-standard deviations from the mean. There were three observations excluded in treatment B and two studies were removed in treatment C (Table 6.3).

Table 6.3: Classification of Original Study Values.

Category	Description
Treatment A	All the observations obtained from the original ROW studies were included. The WTP values were adjusted to the PPP conversion factor.
Treatment B	Three outliers (greater than two standard deviations from the mean) were excluded from treatment A.
Treatment C	Two studies, which consist of the outliers were excluded from treatment A. This reduced 6 observations from the dataset.
Treatment D	All the observations obtained from the original ROW studies were included. The WTP values were adjusted to ratio of the PPP based per capita income between the US and the ROW.
Treatment E	Three outliers (greater than two standard deviations from the mean) were excluded from treatment D.
Treatment F	Two studies, which consist of the outliers were excluded from treatment D. This reduced 6 observations from the dataset. Otherwise, Treatment F = Treatment C.

Furthermore, there have been some studies referred in the beginning of this chapter, where the benefit transfer analyses have been made with an income adjustment to the WTP value of study site and compared with the value obtained in the policy site (Alberini et al, 1996 & Hu, 1995). To analyze this approach of benefit transfer the original WTP values obtained from the ROW studies were adjusted to the ratio of the per capita income of the United States to the ROW.

The income adjustment is given by following expression:

$$WTP_h^{ow} = WTP_v^{ow}\left(\frac{X_u}{X_w}\right) \qquad (6.6)$$

where,

o = original study value

w = 1, ..., 15; study from ROW

$v = 1, \ldots, k$; no of observations of original WTP values before adjustment

$h = 1, \ldots, k$; no of observations of original WTP values adjusted to income

X_u = per capita income of the United States

X_w = PPP adjusted per capita income of the ROW

The income adjustment to the original study values was also based on the purchasing power parity conversion factors. Both the PPP conversion factors and the PPP adjusted per capita income were obtained from the World Bank CD-ROM (World Bank, 1999). Finally, the analysis in this approach was also performed using the three treatment effects due to the skewed distribution of the original WTP values. The treatment D is a basic model, treatment E excludes three outliers, and treatment F excludes two out of sample studies (see Table 6.3).

Moreover, the countries in the ROW include both developed and developing nations. It was expected that the original WTP values obtained from these two different categories of the nations would be different based on the economic as well as socio-cultural distinctions. This issue is even more important in case of non-market valuation of recreational resources and their benefit transfer potentials. This is mainly because the natural and environmental resources are treated very differently in different cultures and at different level of economic development. Though the detailed analysis of the economic and socio-cultural effects on recreational benefit transfer is beyond the scope of this research, to maintain these distinctions and analyze the potential effects on the benefit transfer the original WTP values obtained from ROW studies were classified into two income groups. This classification of the original studies was based on the category of the countries under various levels of per capita income. The World Bank, World Development Report 1996 (World Bank, 1996), categorized the countries into low income, lower middle income, upper middle income and high income. For the convenience of the analysis and also due to small sample size the ROW countries were divided into low income (including lower middle and upper middle income countries) and high income groups. The treatment effects were analyzed in terms of low income, high income and all income groups.

6.5. Test Results and Discussion

6.5.1. Paired t-test: Original Benefit Value Adjusted to Purchasing Power Parity

A meaningful comparison of WTP values across the countries would be the values adjusted to the purchasing power parity of each country. Based on this notion, the benefit transfer analysis was made with the PPP adjustment in the original WTP values of the ROW studies. For this analysis, the paired t-test was performed using EXCEL computer software, and the mean, variance, t-statistics and Pearson's correlation coefficients of the dataset were reported (see Table 6.4-6.9 & Annex 6.5).

The average values of meta-predicted WTP and original WTP under first three treatments are reported in the Table 6.4. In treatment A, the mean values between predicted and original WTP for all samples is very close though mean of original WTP is slightly greater. But, under this treatment, the mean values of predicted WTP is higher in high income countries and much lower in low income countries compared to their respective WTP values from original studies (Table 6.4). The meta-models consistently predicted higher WTP in the benefit transfer evaluation within the United States as discussed in Chapter 6. This is somewhat consistent with the result obtained in case of benefit transfer analysis in high income countries. Also, the original estimates of the WTP was mostly retrieved from studies in Europe, where average WTP value appear to be substantially lower in Europe than North America (Brouwer et al, 1999). However, the mean of the original benefit values of low income countries came out to be much higher than the mean of the predicted values. This result may be contradictory than one would reasonably expect it to be.

The higher mean value of original WTP in the low income counties could potentially be due to the following three reasons. Firstly, the original study values in most studies were measuring the recreation values of the foreign tourists. In this case, the foreign tourists mostly from high income countries would potentially face the budget constraint based on their income (much higher in average compared to the low income countries) and would value the recreational resource as much as they value the typical resource in their home countries. Secondly, the recreation resources valued in the low income countries were mostly in the unique sites. Then, the foreign tourists' values of those resources could even be higher than the value of the recreational resources in average in their home countries. Thirdly, the original WTP values of the low income countries could have been inflated by the small number of studies mostly representing the popular recreational sites.

Table 6.4: Mean of the Meta-Model Predicted WTP vs Original WTP Values Adjusted to 1996 U.S. Dollars (Original WTP Values are Adjusted to PPP Conversion Factors)

Category	All Countries		High Income		Low Income	
	WTPPRE	WTPORI	WTPPRE	WTPORI	WTPPRE	WTPORI
Treatment A	38.70	38.90	40.32	34.91	35.97	45.59
Treatment B	37.78	27.94	38.99	24.18	35.75	34.21
Treatment C	36.79	24.40	37.56	20.77	35.52	30.41

Note: Low income = countries with per capita income below US $8,955,
High income = countries with per capita income above US $8,955.
WTPPRE = meta-model predicted WTP; WTPORI = original WTP obtained from the out of sample studies.

About two-third of the sample WTP values retrieved from the original studies in the low income countries were derived from tourists. Also, in most cases the WTP values were reported in the US dollars. Thus, it is evident that the recreational values of the resources expressed by foreign tourists could be much higher than the value the local residents would potentially willing pay for.

The sites where the original WTP values obtained in low income counties were mostly unique with respect to location or resources. They are mainly popular tourist sites. It is also possible that most of the non-market valuation studies would have been conducted in those sites as the method is not common in low income countries in general. This leads us to another reason why the number of observation in the low income countries have been small. Thus, the mean value of original WTP of low income countries would have been influenced by the studies with few high WTP estimates.

The paired t-test revealed that the meta-predicted value and the original WTP value across all countries together, high income countries and low income countries were statistically not significant (Table 6.5). This implies that the meta-predicted values and original study values are statistically same, i.e., the meta-predicted benefit values converge into the original estimates of WTP, thus, could be transferred to the ROW sites for recreational economic valuation purposes.

Table 6.5: Student t-statistics of Paired t-test Results of the Meta-Model Predicted WTP vs Original WTP Values (Original WTP Values are Adjusted to PPP Conversion Factors)

Category	All Countries	High Income	Low Income
Treatment A	-0.0306 (83)	0.7298 (52)	-0.7484 (31)
Treatment B	3.0303** (80)	4.5922* *(50)	0.2338 (30)
Treatment C	4.4374**(77)	6.2172** (48)	0.8912 (29)

Values in parentheses are sample sizes; * * = t-stat significant at $p<0.05$

Further analysis on comparing meta-predicted values and original WTP values of the ROW was made based on the skewed distribution of the original study values due to few outliers. In treatment B, three observations those beyond two-standard deviations from their mean were excluded from the analysis. Among the excluded observations two came from high income and one from low income groups. In this case, mean values of the meta-predicted WTP across all three groups were higher than the mean of the original study values. The t-statistics showed that only the all countries and high income countries were statistically significant. This implies that the mean values of meta-predicted WTP in all countries together and in high income countries are significantly higher. But, the mean of the predicted value for low income countries was not significantly different. This shows that the meta-predicted benefit value could be transferred to the low income countries but not in the high income countries or the ROW in general. Again, this result needs to be further evaluated based on observation made in case of treatment A.

Moreover, in treatment C the two studies associated with the high original WTP values were excluded from the analysis. A reasonable justification could be that the excluded studies may represent the values of the extraordinarily unique sites or consist methodological differences. The paired t-test on remaining observation revealed that predicted WTP values were higher in all cases but t-statistics were significant only in case of all sample group and the high income group as in treatment B. This result did not change much from the treatment B.

6.5.2. Paired t-test: Original Benefit Value Adjusted to Income Ratio

As discussed in the beginning of this chapter, in most cases benefit transfer possibility has been analyzed comparing the WTP estimates of the study site and that of the policy site with an income adjustment to the WTP value of the policy site (Hu, 1995 and Alberini et al., 1996). This approach of benefit transfer is tested and analyzed in this section in greater details.

The main distinction in the analysis of the results of this section from section 6.5.1 is that the original WTP value obtained from the ROW studies were adjusted to the per capita income ratio given by the equation 6.6. This analysis may serve as a useful mechanism to compare the results with the existing literature. In the income adjustment process, the PPP based per capita income of all the countries included in this analysis were obtained from the World Bank CD-ROM (World Bank, 1999). Then, the ratios of the per capita income of the US to that of the ROW were multiplied by the WTP values of the original studies. While computing the income ratio, special attention had to be paid to the WTP values derived from tourists. In this case, per capita income of the tourists from their country of origin was considered. Also, if the country of the origin of the foreign visitors was not explicit as in some of the out of sample studies, the per capita income of the United States was used.

Similar to the treatments applied in previous section three treatments can be analyzed. In treatment D, all out of sample studies and observations were included. The paired t-test results showed that the mean value of meta-predicted WTP were consistently lower than the original WTP value with income adjustment across high income, low income and all income countries (Table 6.6). This result shows that the adjustment of the income ratio to the original study value would inflate the WTP value, thereby making the benefit transfer value of the US study site to the ROW policy site relatively lower.

Table 6.6: Mean of Meta-Model Predicted WTP vs Original WTP Values Adjusted to 1996 U.S. Dollars and Original WTP Values Adjusted to the Ratio of PPP Based Per Capita Income.

Category	All Countries		High Income		Low Income	
	WTPPRE	WTPORI	WTPPRE	WTPORI	WTPPRE	WTPORI
Treatment D	38.70	54.84	40.32	47.80	35.97	66.65
Treatment E	37.71	42.27	38.99	34.05	35.75	55.97
Treatment F	36.79	38.48	37.56	29.77	35.51	52.91

Note: Low income = countries with per capita income below US $8,955,
High income = countries with per capita income above US $8,955.
WTPPRE = meta-model predicted WTP; WTPORI = original WTP obtained from the out of sample studies.

However, the t-statistics of the paired t-test were not significant in high income data subset model at the $p<0.1$ significance level. But, it is significant at $p<0.1$ in all countries and low income countries dataset (Table 6.7). This implies that the income adjustment to the original benefit value of high income countries would not inflate as much as it does in low income countries. This is mainly because, even after the PPP adjustment to the per capita income of the low income countries their income differential relative to high income countries is still high.

Table 6.7: Student t-statistics of Paired t-test Results of the Meta-Model Predicted WTP vs Original WTP Values (Original WTP Values are Adjusted to the Ratio of PPP Based Per Capita Income)

Category	All Countries	High Income	Low Income
Treatment D	1.9552* (83)	-0.7605 (52)	-2.1080** (31)
Treatment E	-0.9082 (80)	1.1249 (50)	-1.9326* (30)
Treatment F	-0.3589 (77)	2.1256** (48)	-1.6684* (29)

Values in parentheses are sample sizes; ** = t-stat significant at $p<0.05$; * = t-stat significant at $p<0.1$.

Further analyses were also made in treatment E and F of the models to evaluate the effect of the outliers. In treatment E when excluding three outliers beyond two standard deviations from their mean, the mean value of predicted WTP still smaller than the original study values in low income countries and ROW in general. But, it is greater in high income countries. However, the t-statistics are not significant across all countries and high income countries. In case of the treatment F two studies consisting of the outliers each from the high income and low income groups were eliminated. With this adjustment the position of the mean value of the predicted WTP relative to original study value did not change from that of the treatment E for the all countries group. But, now the t-stat is significant at $p<0.1$ in high income and low income groups implying the predicted value is significantly different than the original study values. The PPP based income adjustment yields the similar number of statistically different results in Table 6.5 and in Table 6.7, but the magnitude of the disparities is larger for low income countries in former and all income countries in latter.

6.5.3. Correlation Analysis

As in paired t-tests the correlation analyses were made separately for the original WTP values adjusted for PPP and the values adjusted for per capita income differentials. The Pearson's correlation coefficients between meta-model predicted and original WTP values for both categories are given in the Table 6.8 and 6.9.

Table 6.8: Pearson's Correlation Coefficient of the Meta-Model Predicted WTP vs Original WTP Values (Original WTP Values are Adjusted to the PPP Conversion Factor)

Category	All Countries	High Income	Low Income
Treatment A	0.4474**	0.5474**	0.3504*
Treatment B	0.4425**	0.4691**	0.5085**
Treatment C	0.3719*	0.2725	0.5359**

** = r significant at p<0.01, * = r significant at p<0.05

Table 6.9: Pearson's Correlation Coefficient of the Meta-Model Predicted WTP vs Original WTP Values (Original WTP Values are Adjusted to the Ratio of PPP Based Per Capita Income)

Category	All Countries	High Income	Low Income
Treatment D	0.4649**	0.5468**	0.3899*
Treatment E	0.3916*	0.4549**	0.4556**
Treatment F	0.3101*	0.2666	0.4482**

** = r significant at p<0.01, * = r significant at p<0.05

The results of the Pearson's correlation coefficient analysis revealed that in all cases there were positive correlations between the meta-predicted values and the original WTP values derived from the ROW studies. Furthermore, all coefficients but in the high income groups of both treatment C and F were statistically significant at $p<0.05$ significance level. This result demonstrates that meta-model has a tendency to predict high benefit value for the site which has high recreational economic value and vice versa. This shows that the meta-regression model is capable of consistently predicting a reasonable estimate of the recreational economic values of the policy sites of the countries at least included in this analysis.

6.6. Summary

The international benefit transfer analysis has been much more challenging in terms of the availability of information, differences in economic and socio-cultural settings, and the demography of the recreation visitors. However, the economic value of the recreational resources has not been much different compared to aforementioned variations across the countries. From paired t-test of the mean of meta-predicted values and the mean of original WTP values obtained from the ROW countries we determined that the predicted values using meta-model estimated for the United States were not significantly different from the original study values. This implies that there is a great potential of transferring benefit estimates of recreation economic values obtained from meta-analysis of the United States to the rest of the world. Of course, there has to be an adjustment for the purchasing power parity or income differentials in such a transfer. This approach will have some immediate advantages at least transferring benefits to many of the unique recreation sites around the world, where original benefit estimates of the recreational resources using primary research is not a possibility.

Moreover, the meta-regression model predicts the WTP values of the ROW sites reasonably well when the recreation economic values of those sites are adjusted to the PPP. The analyses also showed that the adjustment of the WTP values of the ROW sites to the income differentials between the high and low income countries would potentially inflate the WTP value by a large amount. Although, generally this improved the convergent validity of the predicted and original estimates the analyses are somewhat influenced by few outliers in the dataset.

Interestingly, the meta-model predicted values revealed a strong positive correlations with the recreation economic values of the ROW sites, which shows a good potential of using meta-analysis approach to benefit transfer in the recreation valuation of the sites and resources around the world.

CHAPTER 7

Summary and Conclusion

7.1. Introduction

This chapter summarizes the methodological contributions and the findings of this research, and draws some specific conclusions regarding meta-analysis and benefit transfer applications in recreation economic decisions.

From the point of view of the theoretical contribution, the study has extended the methodology of valuing non-market goods from the basic CVM and TCM approaches to the benefit transfer through meta-analysis. In this context the benefit transfer mechanism is discussed and it is linked to the meta-analysis technique to obtain a better value to be transferred in outdoor recreation. Thus, this is an application of existing two different methodologies to better serve the valuation problem of non-market resources.

The meta-regression model estimation and the empirical results of the models are discussed. Moreover, the convergent validity of the meta-models in transferring recreation benefits in terms of national out of sample testing and international benefit transfer application are analyzed and discussed.

More importantly, the conclusions of the study are drawn based on the empirical results of the research. This is mainly confined with the benefit transfer approach in recreation economic decisions and obtaining more appropriate benefit transfer value through meta-analysis of existing studies in outdoor recreation in the United States and in other countries around the world.

7.2. Summary of Methodological Contribution

Benefit transfer is a recent method of obtaining an economic value of non-market goods. As it has been decades since the non-market valuation of natural resources and the environment was performed using the contingent valuation method (CVM) and travel cost method (TCM), acknowledging that several approaches of modeling under these two methods are practices. Of course, the non-market valuation methods are based on the neo-classical welfare economics of utility maximization by the individual in consuming any good or service, and non-market goods are weakly complementary to the other normal goods which have market values. Among others, the most important scope of the benefit transfer is that it saves time and resources as it does not require primary research in obtaining the economic values. This study is another building block in the field of benefit transfer in general and recreational benefit transfer in particular.

More importantly, benefit transfer through meta-analysis is the key thesis of this research as has been developed the concept relatively recently in the field of recreational economic valuation. Although, meta-analysis in other sciences has been practiced as a quantitative technique to synthesize research findings, it has been introduced in economics and particularly in natural resource economics very recently. Thus, this study contributes in integrating two different methodologies to obtain a more appropriate value of the natural resources. The appropriateness is in the sense that the study would use existing research to obtain the welfare values of non-market goods, and shows that the value would still converge to the willingness to pay (WTP) value estimated from original studies. In such a case, with given circumstances, the benefit transfer would save much more time and resources and would still provide the benefit value nearly as good as the economic value obtained from primary research.

Furthermore, the use of meta-analysis technique would make substantial contribution to benefit transfer incorporating the possibility of adjusting the variables in the meta-model based on the policy site characteristics and demographics so that decision maker could obtain a more realistic benefit value. Then, this method of benefit transfer would definitely outperform the conventional practices of point estimate transfer and benefit function transfer.

It is also worthwhile to consider from the perspective that the meta-analysis technique of reviewing past literature in any field takes the stock of research findings, essential information, methodological innovation/development and the knowledge on the subject. With a synthesis of these developments, meta-analysis in the field would provide a better account of the current state of research results. Thus, this would definitely make sense that the benefit value obtained from the meta-analysis would provide a better estimate of the recreational values of any current policy sites depending upon the area of interest.

These basic methodological propositions are tested in this study using out of sample testing of the recreational studies of the United States, and the international benefit transfer analysis comparing the meta-model predicted values with the WTP values obtained from the original studies. This testing procedures aim to validate whether the meta-model estimates of WTP converges to the values of the original studies.

7.3. Summary of Empirical Results

The three-decades of outdoor recreation data is prepared updating the review of recreation demand studies of Walsh et al. (1992, 1988) and MacNair (1993), which can be used for a benefit transfer purpose. For continued availability of the average WTP estimates of each recreation activity the point estimates of the recreation values at national level are developed pooling all the studies. The estimates are further segregated into five census regions of the United States so that the regional values could be used if deemed appropriate. There are values for 21 recreation activities estimated from 701 observations and 158 studies. The average WTP value per day of an outdoor recreation activity range from $8.40 for motor boating to $85.74 for rock climbing. All values are expressed in terms of consumer surplus or net willingness to pay person day adjusted to 1996 U.S. dollars. While computing the average point estimates, the observations beyond two standard deviations from their mean were excluded in order to remove the influence of the few outliers in the estimates. However, those outliers were retained in the meta-analysis.

Next, the approach of meta-analysis in estimating a more appropriate WTP value for benefit transfer is performed. The meta-analysis used all 741 observations but only 682 observations were usable in national model, which were distributed across the regional models as well. Although the dataset resembles a panel nature, the test results revealed that there was no such panel effects, thus, a classical OLS regression models were estimated. The classical OLS models could be verified with the weighted least squares (WLS) model using appropriate weight but this is not covered in this study.

Since Chow test statistics showed the differences in national and regional regression models, five meta-regression models were estimated. However, for benefit transfer purposes, national model was shown to be more appropriate.

In the most part the important variables in the meta-regression models showed consistent results with the past literature. The signs and significance of the key variables remained consistent, though some of the variables demonstrated no clear direction across the national and regional meta-models.

There are some important findings to be highlighted in the meta-analysis. The result showed an increase in the overall WTP value of the outdoor recreation activities over time. Also, it is worth noting that there are several new recreation activities introduced in recent years, such as, rock climbing, horseback riding, biking, and snowmobiling; and various new methodologies, namely, random utility model, conjoint analysis and combined revealed and state preference techniques developed in valuing recreation resources.

For more effective benefit transfer a guideline of how to use the information contain in the database and technique to utilize the point estimates or meta-regression model are provided. Although, it is entirely up to the user to decide which technique is appropriate given the circumstances, meta-analysis technique definitely has certain advantages to reflect a better welfare estimate of a policy sites. Specifically, the national meta-model could be used to account for the important characteristics in estimating the WTP value of the policy site, where the benefit estimate is to be transferred.

The meta-regression models estimated in this study were tested in terms of their convergent validity. In-sample tests of the models were performed in Loomis et al.

(1999), which would demonstrate the internal convergent validity of the meta-models. Moreover, the out-of-sample convergence validity tests were performed and extensively analyzed in this study. The out of sample validity tests primarily takes into account the situation, where a real world benefit transfer occurs. In this test procedure, the similarity of meta-predicted WTP values, which were obtained through the meta-regression model adjusted for the variables relevant to the original study, are tested against the WTP estimates of the original studies.

The results of the paired t-test on out-of-sample analysis with respect to the original studies conducted in the United States showed no convergence between the mean values of meta-predicted and original study. The meta-predicted WTP values were significantly higher in terms of using both national as well as regional meta-models. However, there were significant ($p<0.05$) positive correlations between the national meta-model predicted values and those estimates from the original studies. This implies that the national meta-regression mode predicts higher values when the original studies have higher WTP estimates and vice versa. Furthermore, the Chi-square test on the out of sample analysis revealed that there was a systematic effects of the meta-model in predicting WTP values depending upon whether national or regional models used. Overall, the national meta-model is justified as a better predictor of WTP value to be transferred.

The out of sample validity test becomes contradictory when it is performed in the international context. The original studies on outdoor recreation from around the world were obtained and the WTP estimates were compared against the national meta-model predicted values adjusted for the variables relevant to the original studies. For a more consistent comparison the rest of the world (ROW) study values were converted to the 1996 U.S. dollars, and also adjusted for the purchasing power parity (PPP) conversion factors. Despite the potential economic and socio-cultural differences between the United States and the ROW, particularly, developing countries, the paired t-test showed that the meta-model predicted WTP values were not statistically different from the WTP estimates obtained from the original studies conducted in the recreation sites around the world. The potential reasons for higher original WTP values of the recreational resources in ROW being, the WTP values were obtained from foreign tourists, of unique recreation sites, and due to the availability of small number of studies. There was also significant positive correlation between the meta-model predicted values and original estimates obtained for ROW studies, which is consistent with the result drawn from the out of sample analysis in case of the United States.

7.4. Benefit Transfer with Meta-Analysis Conclusion

The benefit transfer approach is one of the important techniques of non-market valuation of recreational resources. The application of this method is desired from the time and cost effectiveness of the technique, which can be used in most outdoor recreation decision making. It is widely believed that not all economic valuation decisions have to be based on the primary research of non-market valuation using CVM, TCM or any other methods. Instead, it is feasible that in many cases existing estimates of economic values could be successfully transferred as the particular case would not warrant a full-blown primary study. For decades the simple average values of benefits have been transferred, such as, U.S. Water Resource Council or U.S. Forest Service unit-day value transfer. The values have been updated since 1962 periodically based on the available new studies and developed methodologies.

More recently, benefit transfer approach has been augmented by the application of meta-analysis, a statistical technique of quantitative review of research findings. This method of taking stock of knowledge from the research conducted over time has been commonly used in education, psychology and health science for several decades. Benefit transfer is, on the other hand, an economic tool of valuing non-market resource based on the existing studies. Since much more developments are undergoing in the methodologies and techniques used in the primary research itself in recreation resources valuation, the transfer of such values has to incorporate those improvements. The meta-analysis technique serves this purpose well, taking into account these developments in the meta-regression model thereby demonstrating greater potential of this technique as benefit transfer tool in outdoor recreation.

With these methodological advantages of the benefit transfer and meta-analysis, the economic values of outdoor recreation in the United States are updated, analyzed and tested. After updating the review of outdoor recreation demand of Walsh et al. (1992, 1988) and MacNair (1993) the current database includes the values and information of three decades. Based on the current database an average value for each recreation activity is computed at national level as well as at regional levels. It is entirely possible that these average WTP values be transferred in a new policy sites or re-computed the benefit value considering the studies from the database. In any case, the analyst will be transferring the point estimates making own judgments regarding the applicability and appropriateness of the transferred value to reflect the original value of the new site.

A more recent and inclusive approach to benefit transfer is to use meta-analysis. This takes into account the important variables developed over time in the original benefit estimates. Thus, this would incorporate the stock of knowledge and information built in the original estimates of the WTP values. More importantly, the benefit estimates using meta-regression model also enable the researcher to account for the important variables key to the policy sites, thus, the value would better reflect the original value the site.

In our estimates of meta-regression models most of the variables revealed consistent signs and significance as suggested by past literature. It was evident that the WTP value of outdoor recreation has increased over time, which may be justified by the increasing importance of such resources and the methodological development in non-market valuation of recreational resources. This is a particular contribution of the meta-analysis taking into consideration the important effects of the variables while transferring the benefits from study sites to new policy sites.

Meta-analysis is expected to provide the WTP value similar to the original value of a policy site. This proposition was tested using out of sample test procedures. The national out of sample test revealed that the meta-model predicted WTP values were significantly different than the original study values implying that benefit transfer would not provide same WTP value that obtained from original primary research. Thus, benefit transfer in this case would not serve the economic valuation purpose in the outdoor recreation. However, the results from the international benefit transfer analysis were distinct. The benefit transfer analysis in case of international recreation studies showed a convergence between meta-model predicted WTP values and the original estimates. In this case, meta-regression models would work well for benefit transfer from the outdoor recreation value of the United States to the typical sites of the countries around the world. In both national as well as international out of sample tests, there were significant positive correlations between meta-model predicted values and the original study values. It shows that meta-model would predict higher value when the recreation resource has greater values or vice versa.

In general, the results of this study showed that the meta-models would work well predicting the economic value of recreational resources in other countries, but they might not work nationally. However, this result should be considered with caution as the out-of-sample tests are constrained by the smaller number of observations. Because meta-analysis relies upon existing studies, which are constantly being performed, the analysis and results of this dissertation could be updated in another ten years.

PART V

SUPPORTING DOCUMENTS

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ANNEXES

Annex 3.1

Coding Guide

Code#	Variable	Coding	If No Data
I. GENERAL STUDY CHARACTERISTICS			
V000	STUDYID	Study number	
V001	ORIGDATA	1,0; 1=if this is the first study to use this data.	
V002	AUTHOR(s)	Name(s)	
V003	STUDYTITLE	Text	
V004	SOURCE/VOL/PAGES	Text	
V005	PUBDATE	Year	
V006	PUBLISHER	Text	
V007	DOCUMENT TYPE	1=journal, 2=book; 3=proceedings; 4=report; 5=thesis or dissertation; 6=working paper	
V008	CTRY NAME	USA or CANADA	
II. BENEFIT MEASURES			
V009	BENMEAS	1=WTP 2=WTA	
V010	MEAN/MED	1,0; 1= Mean, 0 = Median (mean should be reported where possible)	
V011	DOLVALUE	Value converted to per person per day.	
V011b	CURDOL	Current dollars 1996, using implicit price deflators	
V011c	IMPDFL	Implicit price deflators	
V012	YEARVAL	Year, when the CS value recorded	--
V013	ORIGVALUNITS	1=Day 2=Trip 3=Year 4=Season	
V014	STD ER	Std error of mean/median WTP for $ value or study average value	--
V015	CI'S	1,0; 1= Confidence Interval included in report	
V016	NATIONAL	1,0; 1=National	
V017	MULTI-STATE	1,0; 1=Multi-state	
V018	STATE	1,0, 1=State	
V019	ST NAMES	Type in two letter state abbreviation (e.g., CO for Colorado).	--
V019b	REGION	RPA Regions of the USA, category 1 thru 10.	
V19b1	CENSUSREG	Census regions of the USA, category 1 thru 5	
V019c	INCOME	State average from census data	
V019d	AGE	State average from census data	
V019e	EDU	State average from census data	
V019f	POPUL	State average from census data	
V019g	BLACK	State average from census data	
V019h	%BLACK	State average from census data	
V019i	HISPEN	State average from census data	
V019j	%HISPEN	State average from census data	
V020	ESTSELEC	1=author recommendation, 0= only estimate - 1=group protocol, 2=other estimates not recommended by author	

Annex 3.1: Continued ...

Code#	Variable	Coding	If No Data
V021	AVGSITIME	Average on-site time per trip, in hours (convert multiple days by using 12 hrs/day)	--
V022	GROUPSIZE	Average number of people in group	--
V023	TOTSITEVIS	Total number of visits to the area/site per year	--
V024	SEASLNGTH	Season length converted to days (eg, hunting period allowed)	--
V025	ALL/NO-SQ	1,0;1=Yes, valued for existing condition; 0=No	
V026	CHGVAL	1,0;1=Yes, valued for change in quality; 0=No	
V026b	DOLVALCHG	Dollar Value of change	--
V027	CHGDESCRIP	Text, description of change	--
V028	CHGSIZE	% change, absolute change	--
V029	STDYSPONSOR	0=Industry, 1=University, 2=Government, 3=Env/Conservation, 4=Multiple Category of Sponsors, 5=Others,	
V030	NUMSVYSRET	Number of surveys returned	--
V031	RESPRATE	Response rate percent	--
V032	MAILSVY	1,0; 1= if mail survey	0
V033	PHONESVY	1,0; 1=if phone survey	0
V034	INPERSON	1,0; 1=in person	0
V035	SAMPFRAME	1=On-Site; 2=User List; 3=General Population; 4=Others;	
V036	VALMETHOD	1=CVM 0=TCM	
V037	GEOGAREA	Geographic area of visitor origin (avg one-way distance in mile.	--
III. DETAILS OF CVM APPLICATON			
V038	PAYVEHICLE	1=Trip cost; 2=Entrance Fee/Licence; 3= Annual Pass; 4=Others	0
V039	OECVM	1,0; 1=open-ended CVM question	0
V040	ITBID	1,0; 1=if iterative bidding used	0
V041	CONJOINT	1,0; 1=conjoint (rating scale approach)	0
V042	ST&RP	1,0; 1=combined stated & revealed preference	0
V043	PAYCARD	1,0; 1=payment card	0
V044	MIDPTS	1= Mid-point; 2=Amount circled (refers to payment card)	0
V045	PCCAMHUPLF	1,0; 1=cameron-Huppert Likelihood function (refers to payment card)	0
V046	DCCVM	1,0; 1=dichotomous Choice or Referendum	0
V047	SB	1= (SB) Single Bound; 2=(DB,MB) Double Bound or Multiple Bound (refers to dichotomous choice)	0
V048	DCSTAT	1=Logit 2=Probit 3=Non parametric 4=Semi-non parametric (refers to dichotomous choice)	0
V049	CVWTPEQ	1,0; 1=WTPEQ, if equation estimate for any CVM 0=No Equation (refers to open-ended CVM)	0
V050	CVEQTYPE	1=OLS; 2=2SLS; 3=TOBIT; 4=others (refers to open-ended CVM)	0

Annex 3.1: Continued ...

Code#	Variable	Coding	If No Data
V051	HNNEGMEAN	1=No Neg (log of Bid or 1/B*(ln(1+expBo)); 2=neg allowed.	0
V052	CVUPTRUNC	1,0; 1=upper limit, 0=No upper limit of integration	0
V053	CVOUTLIE	1,0;1=removed or "trimmed" outliers; 0= if not or full/ simple	0
V054	PROTESTR	1,0; 1=if protest responses removed; 0=if all observations used	0
IV. DETAILS OF TCM APPLICATION			
V055	TCMTYPE	1=Zonal 2=Individ 3=RUM/MNL	0
V056	TCMEQTYPE	1=OLS; 2=2SLS or SUR; 3=TOBIT; 4=Count data (POISSON, Neg Binomial); 5=Others (includes MNL, NMNL, when TCMTYPE=3,	0
V057	TRUNCADJ	1,0; 1= truncation adjustment	0
V058	ENDOGSTRT	1,0; 1= correct for endogenous stratification	0
V059	TRAVTIMEVAR	1,0; 1=seperate variable given for travel time	0
V060	OPCOSTIME	% of wage rate	--
V060a	OPCTIN	1,0; 1= if V060 has value coded, 0 otherwise	
V061	COSTMILE	Dollar per mile used	--
V062	SUBS	1,0; 1= price of substitution given, or Available Subs.(if demand equation include a variable for substitute)	0
V063	SITEQUAL	1,0; 1=if site quality or facility (indicated by author)	0
V064	HEDTCM	1,0; 1=hedonic TCM	0
V065	LHSFUNCFRM	1=Linear 2=Log,Pois,Negative Binomial; 3=other	0
V066	RHSFUNCFRM	1=Linear 2=Log 3=other	0
V067	EXPENDAT	1,0; 1=expenditure data included in the Study/Report (eg, lodging, fooding, equipment, etc.)	0
V068	TCMWTPTRUNC	1,0; 1= if upper limit of integration truncated, e.g., at max observed TC	0
V069	TCMOUTLIE	1,0; 1= if outliers or multi-destination trips explicitly removed	0
V. STUDY LOCATION			
V070	COUNTY	1,0; 1=conty	
V071	CTY NAME	Type in County name	--
V072	SITE NAME	Type in name of site	--
V073	LAKE/RESERVOIR	1,0; 1=lake/reservoir	
V074	LAKE NAME	Text	--
V075	ESTBAY	1,0; 1= site is estuary or bay	
V076	OCEAN	1=Atlantic, 2=Pacific 3=Gulf of Mexico	0
V077	RIVER	1,0; 1=if recreation site is river based	
V078	RIVNAME	Name of the river	--
V079	GREAT LAKES	1,0; 1=great lakes	
V080	AREASIZE	Size of recreation area in acres	--
V081	NAT FOREST	1,0, 1=natonal forest	
V082	NFNAME	Name of national forest	--

Annex 3.1: Continued ...

Code#	Variable	Coding	If No Data
V083	NATPARK	1,0, 1=national park	
V084	N.P.NAME	Name of national park	--
V085	NRAREA	1,0; 1=national recreation area	
V086	NRANAME	Name of national recreation area	--
V087	W/L AREA	1,0; 1=wildlife refuge or game management area	
V088	W/L AREA NAME	Name of refuge or management area	--
V089	WILDERNESS	1,0; 1=if recreation use is in wilderness area	
V090	WILDNAME	Name of wilderness area	--
V091	STPARKFOR	1,0; 1 if recreation use is in state park or state forest	
V092	STPKNAME	Name of State Park	--
V093	PUBLIC	1,0; 1= public land including federal, state, county/city	
V094	PRIVATE	1,0; 1= private land	
V095	W/L SPECIES	1=BGAME (Deer, Elk, etc); 2 =SGAME (rabbit, quail, dove, etc.); 3=WTRFWL (duck, geese); 4=T&E ; 5=Songbirds; 6=raptors, hawks, eagles, etc.	0
V096	FOREST	1,0; 1= recreation area in forest	
V097	ENV TYPE	1=Wetland 2=Riparian	
V098	WATERQAUL	1,0; 1=water quality was valued or focus of study	
V099	AIRQUAL	1,0; 1=air quality was valued or focus of study,	
V100	DEVELOP	1,0;1=site studied had developed recreation facilities (such as arranged tables etc., eg, camping, boating etc.)	
V101	DISPERSED	1,0; 1=site studied was dispersed recreation with no formal site or facilities (eg, hunting, hiking, etc).	
V102	ROSCLASS	1= Primitive; 2= SPNM; 3= SPM; 4= RN; 5= Rural; 6= Urban	
V103	ACT TYPE 1	1=CAMPING 2=PICNIC 3=SWIM 4=SISEE 5= OFF RD VEHICLE; 6=MTRBOA; 7=FLTBOAT; 8=HIKE; 9=BIKE; 10=DHSKI; 11=X-CSKI; 12=SNMOB; 13=SNPLAY; 14=HUNT; 15=FISH; 16=S/VIEW; 17=HRSEBCK; 18=RESORT; 19=ROCKCLIMB; 20=GENERAL WATER BASED RECREATION; 21=OTHERS.	
V104	ACT TYPE 2	One of the above category of ACTTYPE except the one already chosen.	0
V105	ACT TYPE 3	One of the above category of ACTTYPE except the one already chosen.	0
V106	ACT TYPE 4	One of the above category of ACTTYPE except the one already chosen.	0
V107	NUMACT	Number of activities site offers or typical visitor could participate in at site	
V108	AVGINC	Average income of visitors	--
V109	AVGED	Average education of visitors	--
V110	AVGAGE	Average age	--

Annex 3.1: Continued ...

Code#	Variable	Coding	If No Data If No Data
V111	AVGSEX	M=0, F=1 (% of Female)	--
V112	RESIDENTS	1,0; 1=Residents only	
V113	USEEXP	1,0; 1=Very Experienced (Level of User Experience w/site)	
V114	SUCESRATE	Percent (success rate in hunting)	--
V115	BAG	Number of animals (in hunting)	--
V116	HOUR	1,0; 1 if bag reported is per hour	0
V117	DAY	1,0; 1 if bag reported is per day	0
V118	TRIP	1,0; 1 if bag reported is per trip	0
V119	HIQUAL	1,0; 1=author states site is of high quality (e.g., popular, unique, well-known, only in the region, etc.)	0
V120	DATAYEAR	Year data collected	--
V121	SAMPSIZE	Total sample size	
V122	NUMTCZONES	Number of zones or origins in zonal TCM.	--
V123	MULTSITE	1,0; 1=if multiple sites considered	0
V124	NUMSITES	Number of sites modeled in multi-site or RUM models	--
V125	CHOICEOC	Number of choice occasions (frequency)	--
	COMMENTS	Text field where coder can write anything special or unusual about study, or details about recreation site or area where study was performed.	

Annex 4.1
Studies Included in the Meta-Regression Analysis

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Annex 4.2
Confidence Interval and Standard Deviation of the Recreation Economic Values

(in 1996 U.S. dollars)

Activity	N	Mean	Stdev	95% Confidence Interval			Mean + 2stdev	Mean – 2stdev
Camping	23	35.07	43.09	17.46	-	52.69	121.26	-51.11
Picnicking	6	48.06	37.03	18.43	-	77.69	122.12	-26.00
Swimming	7	31.67	38.20	3.37	-	59.96	108.06	-44.72
Sightseeing	56	32.45	26.99	25.38	-	39.52	86.43	-21.54
Off-road Driving	2	26.79	9.68	13.37	-	40.21	46.16	7.43
Float Boating	11	37.71	53.84	5.89	-	69.53	145.39	-69.97
Motor Boating	6	49.37	30.59	24.90	-	73.85	110.55	-11.81
Hiking/Backpacking	14	40.38	55.52	11.30	-	69.47	151.42	-70.65
Biking	5	45.15	18.79	28.68	-	61.63	82.74	7.56
Downhill Ski	4	21.75	8.92	13.01	-	30.48	39.58	3.91
Cross Country Ski	4	20.64	10.04	10.80	-	30.48	40.73	0.56
Snow Mobiling	2	69.97	47.71	3.84	-	136.09	165.39	-25.45
Big game Hunting	167	44.55	29.56	40.06	-	49.03	103.67	-14.57
Small game Hunting	18	36.17	42.85	16.37	-	55.96	121.87	-49.54
Waterfowl Hunting	59	30.74	30.42	22.97	-	38.50	91.58	-30.11
Fishing	114	35.87	38.13	28.87	-	42.87	112.14	-40.40
Wildlife Viewing	113	32.05	18.23	28.69	-	35.41	68.52	-4.41
Rock Climbing	5	59.52	25.16	37.47	-	81.57	109.83	9.20
General Recreation (mean of all types)	49	22.82	30.75	14.22	-	31.43	84.32	-38.67
Others	7	48.86	56.59	6.94	-	90.78	162.04	-64.32

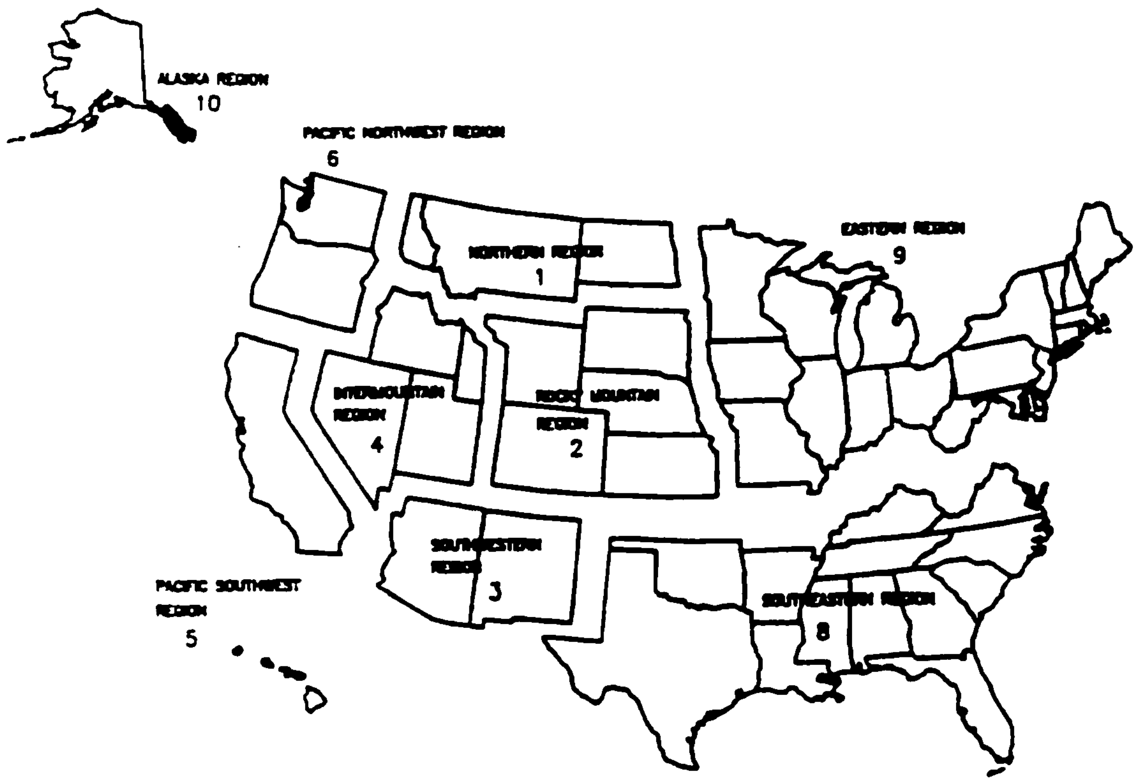
N = Number of observation.

Annex 4.3
Full Specification National Meta-Regression Model

Variable	Coefficient	Standard Error Corrected	Standard Error Uncorrected	Mean	Standard Deviation
CS		-------	--------	36.1	32.39
BGHUNT	27.86622	15.52399	11.18667	0.249267	0.432906
BIKE	-5.2075	14.95427	17.5944	0.007331	0.085372
CAMP	17.61073	17.2284	12.19606	0.033724	0.180651
DCCVM	3.9405	11.46643	12.82355	0.178886	0.383538
DEVELOP	-5.57	10.39857	6.333843	0.186217	0.389567
DHSKI	22.77827	22.45838	18.44545	0.005865	0.076415
FISH	20.9818	15.89343	10.72733	0.173021	0.378543
FOREST	-6.27609	6.942225	4.502862	0.303519	0.460115
FSADMIN	-15.2092	6.323305	4.46424	0.136364	0.343426
GENREC	14.11918	22.31017	12.806	0.067449	0.250982
HIKE	7.626922	19.59412	13.42668	0.020528	0.141901
HORSE	-1.2599	18.95672	31.1826	0.001466	0.038292
INDIVID	-21.3539	18.49881	18.48297	0.13783	0.344974
INPERSON	-6.00107	9.570883	6.722204	0.346041	0.476056
ITBID	-2.70652	9.228026	12.41919	0.099707	0.299828
LAKE	-12.9727	10.07427	7.092272	0.049853	0.217802
LINLIN	8.758744	10.7102	8.056802	0.105572	0.307514
LOGLIN	7.083684	10.06485	7.835582	0.155425	0.362575
LOGLOG	3.429105	13.06564	8.758588	0.06305	0.243231
MAIL	-7.00676	5.764293	5.18048	0.249267	0.432906
METHOD	-36.9532	13.32861	17.387	0.63783	0.48098
MTRBOAT	17.09233	18.97743	13.37707	0.016129	0.126064
NATL	14.77118	34.41836	15.20069	0.030792	0.17288
NOMTRBT	12.60625	18.20198	15.68321	0.008798	0.093451
NUMACT	-0.104	0.709392	0.391643	4.63783	9.079802
OE	-7.91009	9.596337	12.51888	0.356305	0.479258
OFFRD	4.453174	15.40839	22.94974	0.002933	0.054113
ONSITE	5.499931	14.75884	8.926464	0.294721	0.456252
PAYCARD	-34.2455	21.77896	23.45039	0.002933	0.054113
PHONE	-20.9225	7.294777	5.412573	0.508798	0.50029
PICNIC	12.32668	17.07845	16.11801	0.008798	0.093451
PUBLIC	19.95115	12.44554	8.495798	0.960411	0.195136
R1	10.87348	13.46123	11.58977	0.052786	0.22377
R10	-8.9159	12.40015	12.72066	0.026393	0.160419
R2	-3.38031	12.0302	10.89927	0.120235	0.325474
R3	-0.65972	13.56564	11.61615	0.061584	0.240574
R4	2.174196	12.65536	11.03891	0.11437	0.318493
R5	-6.07343	12.37294	11.63132	0.05132	0.220811
R6	-13.5621	12.29804	11.51753	0.061584	0.240574
R8	-6.29756	11.84111	10.868	0.164223	0.37075
R9	-4.33819	12.46367	10.74127	0.302053	0.459485
RECQUAL	9.320128	12.51677	6.113346	0.109971	0.313083
RIVER	21.1175	9.475942	6.873323	0.042522	0.201925
ROCKCL	60.90751	16.26918	19.84559	0.007331	0.085372

Annex 4.3: Continued ...

Variable	Coefficient	Standard Error Corrected	Standard Error Uncorrected	Mean	Standard Deviation
RUM	-28.6369	17.95435	18.60185	0.027859	0.16469
SISEE	11.04318	22.29566	14.21739	0.020528	0.141901
SMHUNT	19.67442	16.45527	12.83658	0.026393	0.160419
SNOWMOB	1.707816	20.41568	31.81095	0.001466	0.038292
SPRP	-31.5644	17.34132	19.8877	0.007331	0.085372
SUBS	-21.3041	10.87894	5.084327	0.258065	0.437891
SWIM	6.016771	18.12029	15.15047	0.010264	0.100864
TREND	1.245987	0.662287	0.374496	19.03666	5.329673
TTIME	3.163665	11.56638	6.672158	0.312317	0.463778
VALUNIT	-10.0615	4.968103	3.97863	0.391496	0.488443
WATFOWL	23.14513	16.04657	11.49351	0.08651	0.281322
WLVIEW	12.60541	15.65576	11.32462	0.227273	0.419378
XSKI	8.803296	15.83987	17.97128	0.005865	0.076415
ZONAL	-34.9994	17.6617	18.37373	0.196481	0.397628
C	37.23911	35.14413	25.85928	--------	----------
Adjusted R2	0.26				
F-STAT	[58, 623]				



Annex 4.4: Map of the United States showing RPA regions.

Annex 4.5
Mean of the Independent Variables in the Meta-Regression Models

Variables	NATL	R1	R2	R3	R45
BGHUNT	0.249267	0.26699	0.232143	0.285714	0.168421
BIKE	0.007331	0.004854	0.008929	0.008403	0
CAMP	0.033724	0.014563	0.053571	0.042017	0.031579
CONJOINT	0.004399	0	0	0	0
DCCVM	0.178886	0.208738	0.25	0.155462	0.136842
DEVELOP	0.186217	0.131068	0.160714	0.163866	0.315789
DHSKI	0.005865	0	0	0.008403	0.010526
FISH	0.173021	0.203883	0.116071	0.163866	0.168421
FOREST	0.303519	0.276699	0.276786	0.361345	0.315789
FSADMIN	0.136364	0.160194	0.071429	0.147059	0.178947
GENREC	0.067449	0.038835	0.053571	0.071429	0.157895
HIKE	0.020528	0.009709	0.017857	0.012605	0.063158
HORSE	0.001466	0	0	0	0
INDIVID	0.13783	0.126214	0.080357	0.117647	0.263158
INPERSON	0.346041	0.320388	0.330357	0.319328	0.431579
ITBID	0.099707	0.101942	0.125	0.109244	0.073684
LAKE	0.049853	0.033981	0.089286	0.046218	0.031579
LINLIN	0.105572	0.063107	0.035714	0.138655	0.178947
LOGLIN	0.155425	0.11165	0.080357	0.142857	0.252632
LOGLOG	0.06305	0.053398	0.071429	0.054622	0.063158
MAIL	0.249267	0.218447	0.107143	0.327731	0.231579
METHOD	0.63783	0.747573	0.8125	0.634454	0.368421
MTRBOAT	0.016129	0	0.017857	0.016807	0.042105
NOMTRBT	0.008798	0.009709	0	0.008403	0.010526
NUMACT	4.63783	3.466019	2.910714	3.05042	6.642105
OE	0.356305	0.436893	0.4375	0.365546	0.157895
OFFRD	0.002933	0	0	0	0.010526
ONSITE	0.294721	0.276699	0.321429	0.235294	0.389474
PAYCARD	0.002933	0	0	0.008403	0
PHONE	0.508798	0.626214	0.75	0.407563	0.357895
PICNIC	0.008798	0.004854	0.008929	0.004202	0.021053
PUBLIC	0.960411	0.970874	0.982143	0.983193	1
R1	0.052786	0	0	0.151261	0
R2	0.120235	0	0	0.344538	0
R3	0.061584	0	0	0.176471	0
R4	0.11437	0	0	0.327731	0
R5	0.05132	0	0	0	0.368421
R6	0.061584	0	0	0	0.442105
R8	0.164223	0	1	0	0
R9	0.302053	1	0	0	0
R10	0.026393	0	0	0	0.189474
RECQUAL	0.109971	0.097087	0.089286	0.105042	0.2
RIVER	0.042522	0.019417	0.008929	0.067227	0.052632
ROCKCL	0.007331	0.009709	0	0.012605	0
RUM	0.027859	0.009709	0.017857	0.008403	0.115789

Annex 4.5: Continued ...

Variables	NATL	R1	R2	R3	R45
SISEE	0.020528	0.004854	0.035714	0.029412	0.010526
SMHUNT	0.026393	0.014563	0	0.054622	0
SNOWMOB	0.001466	0	0	0.004202	0
SPRP	0.007331	0	0	0.012605	0
SUBS	0.258065	0.165049	0.133929	0.260504	0.463158
SWIM	0.010264	0.024272	0	0	0.010526
TREND	19.03666	20.13107	20.23214	17.07983	20.75789
TTIME	0.312317	0.208738	0.151786	0.340336	0.505263
CS	36.10037	35.037	30.13239	39.27653	36.95174
VALUNIT	0.391496	0.38835	0.339286	0.42437	0.284211
WATFOWL	0.08651	0.11165	0.098214	0.079832	0.063158
WLVIEW	0.227273	0.271845	0.339286	0.159664	0.231579
XSKI	0.005865	0.009709	0	0.004202	0
ZONAL	0.196481	0.116505	0.089286	0.247899	0.242105

Annex 4.6
Different Functional Forms of National Meta-Models Including Income

Variables	OLSLIN	SEMILOG	OLSINC	SEMILOGINC
BGHUNT	12.4777*	0.4357*	12.5731*	12.5762*
	(3.1069)	(0.0935)	(3.9943)	(3.9959)
BIKE	-13.5685	0.0793	-13.7031	-13.7022
	(8.4164)	(0.1925)	(9.2698)	(9.2789)
FISH	9.0575*	0.2659*	9.0936*	9.0971*
	(4.1953)	(0.1162)	(4.6225)	(4.6231)
FSADMIN	-20.0557*	-0.4988*	-20.3494*	-20.3337*
	(4.3000)	(0.1511)	(5.1424)	(5.1450)
HORSE	-11.8409*	-0.2562*	-12.1746*	-12.1899*
	(5.6929)	(0.1450)	(6.2908)	(6.3066)
INCOME			0.0003	5.2305
			(0.0004)	(10.9493)
LAKE	-16.8031*	-0.7537*	-16.7538*	-16.7563*
	(6.7226)	(0.2848)	(6.8239)	(6.8205)
METHOD	-17.5985*	-0.3450*	-17.6783*	-17.6598*
	(7.3034)	(0.1457)	(6.9857)	(6.9777)
OE	-7.4684*	-0.3700*	-7.2545*	-7.2720*
	(3.8322)	(0.1335)	(4.0601)	(4.0645)
OFFRD	-7.8984*	0.0754	-8.1805	-8.1857
	(4.7806)	(0.1808)	(8.3797)	(8.3893)
PAYCARD	-28.3327	-1.8204	-28.2221	-28.2413
	(19.7468)	(1.2052)	(19.6712)	(19.6496)
PHONE	-18.6264*	-0.1313	-18.8007*	-18.7874*
	(4.3783)	(0.1428)	(4.7327)	(4.7357)
PUBLIC	21.6545*	0.5244*	22.0506*	22.0896*
	(6.6484)	(0.1620)	(7.2054)	(7.2453)
R2	-6.5813*	-0.0682	-7.1475*	-7.1891*
	(3.8383)	(0.0992)	(4.1445)	(4.1504)
R5	-10.4485	-0.2925*	-11.4728*	-11.5070*
	(7.1285)	(0.1816)	(6.7052)	(6.7356)
R6	-14.2176*	-0.2941*	-14.9166*	-14.9677*
	(4.3552)	(0.1388)	(5.4840)	(5.5571)
R8	-8.7566*	-0.2538*	-8.9166*	-8.9360*
	(3.5255)	(0.1031)	(3.6370)	(3.6419)
R9	-7.1241*	-0.2242*	-7.9844*	-7.9845*
	(3.7302)	(0.1043)	(4.4303)	(4.4702)
R10	-14.9798*	-0.2393*	-15.9590*	-15.9963*
	(7.3170)	(0.1385)	(7.7951)	(7.8831)
RIVER	17.7468*	0.2387	17.6596*	17.6740*
	(9.7930)	(0.2029)	(8.8303)	(8.8266)
ROCKCL	39.7381*	1.6677*	38.6736*	38.7181*
	(10.7421)	(0.5834)	(12.5978)	(12.6164)
SNOWMOB	-20.2993*	-0.1719	-19.8957	-19.8995
	(9.0849)	(0.0752)	(14.0660)	(14.0479)
SPRP	-38.1698*	-1.3114*	-37.5968*	-37.6067*
	(10.9394)	(0.5239)	(9.7874)	(9.7588)
SUBS	-20.2770*	-0.4537*	-20.3360*	-20.3250*
	(6.7020)	(0.1552)	(5.9186)	(5.9147)

Annex 4.6: Continued ...

Variables	OLSLIN	SEMILOG	OLSINC	SEMILOGINC
TREND	1.6132*	0.0372*	1.6255*	1.6256*
	(0.3900)	(0.0121)	(0.4660)	(0.4666)
VALUNIT	-5.8206	-0.0439	-6.0194	-6.0019
	(4.2432)	(0.1240)	(5.5437)	(5.5408)
WATFOWL	10.1615*	0.2137	10.2601*	10.2604*
	(4.5934)	(0.1365)	(4.8913)	(4.8897)
CONSTANT	19.1594	2.6870*	13.9873	-33.3264
	(12.3959)	(0.2804)	(15.8617)	(109.9196)
Adjusted R2	0.2544	0.2768	0.2544	0.2544
F-STAT	9.6043*	11.0280*	9.6049*	9.6043*
	[26, 655]	[26,655]	[27, 654]	[27, 654]

values in parentheses are standard errors of parameters estimated for heteroskesdasticity and serial correlation using the Newey-West version of White's consistent covariance estimators and lag 6 periods, * = p<0.10 or better based on t-statistics from corrected standard errors of the estimated parameters, values in brackets are F-Stat degrees of freedom.

Annex 5.1
Coding Sheet for Out of Sample Studies

Acticity:

Study # Study site National study RPA Region Census Region States		
Variable	**Values**	**Comments:**
C		
BGHUNT		
BIKE		
CAMP		
DCCVM		
DEVELOP		
DHSKI		
FISH		
FOREST		
FSADMIN		
GENREC		
HIKE		
HORSE		
INDIVID		
INPERSON		
ITBID		
LAKE		
LINLIN		
LOGLIN		
LOGLOG		
MAIL		
METHOD		
MTRBOAT		
NATL		
NOMTRBT		
NUMACT		
OE		
OFFRD		
ONSITE		
PAYCARD		
PHONE		
PICNIC		

Annex 5.1: Continued ...

Variable	Values	Comments:
PUBLIC		
R1		
R2		
R3		
R4		
R5		
R6		
R8		
R9		
R10		
RECQUAL		
RIVER		
ROCKCL		
RUM		
SISEE		
SMHUNT		
SNOWMOB		
SPRP		
SUBS		
SWIM		
TREND		
TTIME		
VALUNIT		
WATFOWL		
WLVIEW		
XSKI		
ZONAL		

Annex 5.2
Studies Included in the Out of Sample Analysis in the United States

Agricultural Enterprise Inc., University of Idaho and Normandean Associates (1998). Outdoor Recreation use and Value on Lower Snake River Reservoirs. Report prepared for the *Department of the Army Corps of Engineers*, Walla Walla, Washington. 105p.

Boyle, Kevin J., Brian Roach, David G. Waddington, Jamie Clark and Bob Lange (1998). 1996 Net Economic Values for Bass, Trout and Walleye Fishing, Deer, Elk and Moose Hunting, and Wildlife Watching- Addendum to the 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation. *U.S. Fish and Wildlife Service.*

Coupal, Roger H., Chris Bastian, Juliet May and David T. Taylor (1998). The Economic Benefits of Snowmobiling in Wyoming: A Travel Cost Approach with Market Segmentation. An unpublished paper, *Dept. of Agricultural and Applied Economics, University of Wyoming.* 14p.

Hackett, Steven C. (1999). The Recreational Economic Benefits from Wilderness Visitation in the Eastern Trinity Alps. An unpublished paper, *School of Business and Economics, Humboldt State University, Arcata.* 9p.

Hansen, LeRoy, Peter Feather, and David Shank (1999). Valuation of Agriculture's Multi-site Environmental Impacts: An Application of Pheasant Hunting. *Agricultural and Resource Economics Review*, Oct. 1999: 199-207.

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Annex 5.3
Meta-Model Predicted Values and the WTP Values from Original Studies

(Adjusted to 1996 dollars)

Region/Site	Activity	Predicted Value using meta-models		Original Study Value			
		National	Regional	WTP/day	95% Confidence Interval		
Pacific	Fishing	16.40	29.46	1.97	-20.44	-	24.37
Mountain	Fishing	49.46	40.59	26.65	19.65	-	32.84
West north central	Fishing	42.34	34.47	16.78	11.74	-	21.22
West north central	Fishing	NA	40.59	16.78	11.74	-	21.22
East north central	Fishing	48.92	34.47	23.69	18.48	-	29.80
New England	Fishing	48.92	34.47	9.87	-1.08	-	20.88
East south central	Fishing	47.29	12.12	18.76	-5.39	-	43.18
Mountain	Hunting	51.94	40.94	57.26	30.37	-	83.91
West north central	Hunting	44.81	57.20	25.67	16.71	-	35.18
West north central	Hunting	NA	40.94	25.67	16.71	-	35.18
East north central	Hunting	51.40	57.20	23.69	14.39	-	32.96
New England	Hunting	51.40	57.20	28.63	22.19	-	35.12
West south central	Hunting	49.76	43.56	68.11	4.27	-	131.65
East south central	Hunting	49.76	43.56	22.70	0.74	-	47.34
Pacific	Viewing	6.40	44.58	18.76	4.47	-	32.95
Mountain	Viewing	32.34	35.49	30.60	25.16	-	35.23
Mountain	Viewing	NA	42.03	30.60	25.16	-	35.23
Mountain	Viewing	NA	21.87	30.60	25.16	-	35.23
West north central	Viewing	32.34	35.49	16.78	13.70	-	18.94
West north central	Viewing	NA	21.87	16.78	13.70	-	18.94
New England	Viewing	38.92	35.49	15.79	11.15	-	21.36
West south central	Viewing	37.29	42.03	23.69	18.34	-	28.14
East south central	Viewing	37.29	42.03	8.88	-2.76	-	12.72
South Atlantic	Viewing	30.16	35.49	9.87	-10.37	-	30.01
South Atlantic	Viewing	NA	42.03	9.87	-10.37	-	30.01
WA: snow lake	Hiking	52.34	32.69	31.29	27.12	-	37.11
WA: Stuart/Colchuck	Hiking	52.34	32.69	21.77	19.78	-	24.14
ND: Missouri & other 5 rivers	River Rec	62.35	84.55	32.44	NA	-	NA
Midwest Region	Sm Hunt	58.03	74.47	26.00	18.66	-	46.65
Midwest Region	Sm Hunt	NA	12.51	26.00	18.66	-	46.65
WA: Alpine Lake Wild	Hiking	36.52	32.69	7.15	NA	-	NA
WY: Snow mobiling	Snowmob	35.37	67.57	42.92	NA	-	NA
CA: Eastern Trinity Alps	Hiking	43.27	13.84	28.37	22.76	-	37.74
ME: Dead river	Flt boat	79.01	29.65	113.57	75.20	-	172.16
WA: Lower snake river reserv.	Gen rec	68.25	57.41	35.02	23.11	-	72.78
Observation		28	35	35			

Annex 6.1
Studies Included in the International Benefit Transfer Analysis

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Annex 6.2
Meta-Model Predicted Values and WTP Estimates from Original International Studies (Original Estimates Adjusted for Purchasing Power Parity)

(in 1996 U.S. dollars)

COUNTRY	SITE	ACTIVITY	WTPPRE	WTPORI
Italy	Lentiai	Hunt:hares, birds	33.11	4.99
Italy	Limana	Hunt:hares, birds	33.11	14.25
Italy	Livinallongo	Hunt:ungulates	42.85	32.79
Italy	Vendicari wetland	Bird watching	42.14	12.55
Italy	Vendicari wetland	Bird watching	42.14	12.87
Italy	Tonezza del Cimone alpine reserve, Vicenza	Hunt: roe deer, chamois, forcello grouses, hare	44.68	11.09
Italy	Tonezza del Cimone alpine reserve, Vicenza	Hunt: roe deer, chamois, forcello grouses, hare	44.68	38.73
Italy	Florence	Hunt: big & small game	46.89	30.14
Italy	Florence	Hunt: Non-miragroty waterfowl	42.90	26.24
Italy	Florence	Hunt: Ungulates	55.37	29.84
Italy	Florence	Hunt: mirgatory waterfowl	53.06	20.58
Italy	Florence	Hunt: big & small game	46.89	29.32
Italy	Florence	Hunt: Non-miragroty waterfowl	42.90	24.25
Italy	Florence	Hunt: Ungulates	55.37	25.55
Italy	Florence	Hunt: mirgatory waterfowl	53.06	18.41
Italy	National-Italy	General recreation	24.86	21.14
Madagascar	Mantadia national park	General recreation	58.13	34.83
Madagascar	Mantadia national park	General recreation	44.40	12.86
Canada	Ontario parks: Algonquin	Camping &cannoing	33.87	58.54
Canada	Ontario parks: Quetico	Camping &cannoing	33.87	57.20
Canada	Ontario parks: Killarney	Camping &cannoing	33.87	58.01
Canada	Ontario parks: Algonquin	Camping &cannoing	33.87	19.42
Canada	Ontario parks: Quetico	Camping &cannoing	33.87	24.88
Canada	Ontario parks: Killarney	Camping &cannoing	33.87	18.76
UK	River Darent	Instream flow: fishing, viewing	72.43	12.44
UK	River Darent	Instream flow: fishing, viewing	72.43	7.08
Costa Rica	Poas Volcano	Gen rec: NP visits	37.93	11.23
Costa Rica	Poas Volcano	Gen rec: NP visits	37.93	23.48
Costa Rica	Manual Antonio Park	Gen rec: NP visits	37.93	13.27
Costa Rica	Manual Antonio Park	Gen rec: NP visits	37.93	14.29
Costa Rica	Monteverde Cloud Forest Reserve	Campinig, sightseeing, horseback riding	39.85	59.11
Costa Rica	Poas Volcano	Gen rec: NP visits	11.13	12.30
Costa Rica	Irazu	Gen rec: NP visits	11.13	9.91
Costa Rica	Maunal Antonio park	find from web	11.13	16.06
South Africa	Kwazulu-Natal: Hluhluwe	Wildlife view, Drive, Sightsee, Camp	33.18	29.16
South Africa	Kwazulu-Natal: Umfolozi	Wildlife view, Drive, Sightsee, Camp	33.18	17.87
South Africa	Kwazulu-Natal: Ilata	Wildlife view, Drive, Sightsee, Camp	33.18	11.95
South Africa	Kwazulu-Natal: Mkuzi	Wildlife view, Drive, Sightsee, Camp	33.18	10.85

Annex 6.2: Continued ...

COUNTRY	SITE	ACTIVITY	WTPPRE	WTPORI
South Korea	North & South Kyongsong Province	Hunt:big game	54.62	129.68
South Korea	Mt. Minju	Wildlife view	45.37	23.95
South Korea	Mt. Minju	Wildlife view	45.37	26.95
Finland	Repokallio-summer	Hike, skiing	13.82	2.02
Finland	Repokallio-winter	Hike, skiing	13.82	2.33
Finland	Linnunlahti-summer	Hike, skiing	13.82	2.24
Finland	Linnunlahti-winter	Hike, skiing	13.82	1.84
Finland	Lykynlampi-summer	Hike, skiing	13.82	2.06
Finland	Lykynlampi-winter	Hike, skiing	13.82	2.19
Spain	Gran Canaria (Canary Island)	Sight see, camp, hike	34.67	12.41
Spain	Gran Canaria (Canary Island)	Sight see, camp, hike	42.14	12.23
Australia	Carnarvon Gorge NP	Camping & viewing	59.74	22.40
Canada	Nopiming	Canoe, fish, hunt, moterboat, camp	73.44	59.18
Canada	Atikaka	Canoe, fish, hunt, moterboat, camp	73.44	252.89
Canada	Whiteschell	Canoe, fish, hunt, moterboat, camp	73.44	152.78
Canada	Woodland Caribou	Canoe, fish, hunt, moterboat, camp	73.44	353.60
Canada	Foothills Model Forest	Camping	41.07	25.81
Madagascar	Beza Mahafaly Special Reserve	Wildlife viewing	54.90	99.84
Madagascar	Beza Mahafaly Special Reserve	Wildlife viewing	54.90	131.49
Costa Rica	Monteverde Cloud Forest Reserve	Campinig, sight seeing, horseback riding	36.62	44.72
Kenya	Kenya NP & Reserve	Wildlife view, Offroad drive, sightsee	26.81	76.69
UK	Forest: Brecon	Outdoor recreation	32.64	4.80
UK	Forest: Cuchan	Outdoor recreation	32.64	4.17
UK	Forest: Cheshire	Outdoor recreation	32.64	3.53
UK	Forest: Lorne	Outdoor recreation	32.64	2.66
UK	Forest: New Forest	Outdoor recreation	32.64	2.64
UK	Forest: Ruthin	Outdoor recreation	32.64	4.65
Belgium	Heverleebos & Meerdaawoud	Hiking	41.71	12.52
Belgium	Heverleebos & Meerdaawoud	Biking	28.14	9.88
Ecuador	Galapagos	Ecotourism: Sight see, mountain climb, hiking, bird watching	42.61	387.03
Ecuador	Amazon	Ecotourism: Sight see, mountain climb, hiking, bird watching	42.61	144.62
Madagascar	Mantadea NP	Ecotourism: sight see, wildlife viewing	34.62	25.88
Madagascar	Mantadea NP	Ecotourism: sight see, wildlife viewing	45.37	34.69
New Zealand	Greenstone & Caples	Big game hunt	42.75	49.26
New Zealand	Greenstone & Caples	Fishing	39.33	38.70
New Zealand	Greenstone & Caples	Trekking	30.27	23.93

Annex 6.2: Continued ...

COUNTRY	SITE	ACTIVITY	WTPPRE	WTPORI
New Zealand	Greenstone & Caples	Big game hunt	42.75	65.45
New Zealand	Greenstone & Caples	Fishing	39.33	43.63
New Zealand	Greenstone & Caples	Trekking	30.27	36.59
Malaysia	Jeram Lanang	Forest rec: hiking, camping	16.01	0.97
Malaysia	Telok Bahang	Forest rec: hiking, camping	16.01	1.31
Malaysia	Gunung Pulai	Forest rec: hiking, camping	16.01	2.00
Malaysia	Jeram Lanang	Forest rec: hiking, camping	41.07	0.72
Malaysia	Telok Bahang	Forest rec: hiking, camping	41.07	2.20
Malaysia	Gunung Pulai	Forest rec: hiking, camping	41.07	3.47

Annex 6.3
Meta-Model Predicted Values and WTP Estimates from Original International Studies (Original Estimates Adjusted for the Per Capita Income Ratio)

COUNTRY	SITE	ACTIVITY	WTPPRE	WTPORI
Italy	Lentiai	Hunt:hares, birds	33.11	7.01
Italy	Limana	Hunt:hares, birds	33.11	20.04
Italy	Livinallongo	Hunt:ungulates	42.85	46.09
Italy	Vendicari wetland	Bird watching	42.14	17.65
Italy	Vendicari wetland	Bird watching	42.14	18.09
Italy	Tonezza del Cimone alpine reserve, Vicenza	Hunt: roe deer, chamois, forcello grouses, hare	44.68	15.59
Italy	Tonezza del Cimone alpine reserve, Vicenza	Hunt: roe deer, chamois, forcello grouses, hare	44.68	54.46
Italy	Florence	Hunt: big & small game	46.89	42.38
Italy	Florence	Hunt: Non-miragroty waterfowl	42.90	36.90
Italy	Florence	Hunt: Ungulates	55.37	41.95
Italy	Florence	Hunt: mirgatory waterfowl	53.06	28.94
Italy	Florence	Hunt: big & small game	46.89	41.22
Italy	Florence	Hunt: Non-miragroty waterfowl	42.90	34.10
Italy	Florence	Hunt: Ungulates	55.37	35.92
Italy	Florence	Hunt: mirgatory waterfowl	53.06	25.89
Italy	National-Italy	General recreation	24.86	29.73
Madagascar	Mantadia national park	General recreation	58.13	34.83
Madagascar	Mantadia national park	General recreation	44.40	12.86
Canada	Ontario parks: Algonquin	Camping &cannoing	33.87	75.59
Canada	Ontario parks: Quetico	Camping &cannoing	33.87	73.85
Canada	Ontario parks: Killarney	Camping &cannoing	33.87	74.91
Canada	Ontario parks: Algonquin	Camping &cannoing	33.87	25.08
Canada	Ontario parks: Quetico	Camping &cannoing	33.87	32.12
Canada	Ontario parks: Killarney	Camping &cannoing	33.87	24.23
UK	River Darent	Instream flow: fishing, viewing	72.43	17.55
UK	River Darent	Instream flow: fishing, viewing	72.43	9.99
Costa Rica	Poas Volcano	Gen rec: NP visits	37.93	48.57
Costa Rica	Poas Volcano	Gen rec: NP visits	37.93	23.48
Costa Rica	Manual Antonio Park	Gen rec: NP visits	37.93	57.40
Costa Rica	Manual Antonio Park	Gen rec: NP visits	37.93	14.29
Costa Rica	Monteverde Cloud Forest Reserve	Campinig, sight seeing, horseback riding	39.85	59.11
Costa Rica	Poas Volcano	Gen rec: NP visits	11.13	12.30
Costa Rica	Irazu	Gen rec: NP visits	11.13	9.91
Costa Rica	Maunal Antonio park	find from web	11.13	16.06
South Africa	Kwazulu-Natal: Hluhluwe	Wildlife view, Drive, Sight see, Camp	33.18	111.05
South Africa	Kwazulu-Natal: Umfolozi	Wildlife view, Drive, Sight see, Camp	33.18	68.06
South Africa	Kwazulu-Natal: Ilata	Wildlife view, Drive, Sight see, Camp	33.18	45.52
South Africa	Kwazulu-Natal: Mkuzi	Wildlife view, Drive, Sight see, Camp	33.18	41.32

Annex 6.3: Continued ...

COUNT	SITE	ACTIV	WTPPRE	WTPORI
South Korea	North & South Kyongsong Province	Hunt:big game	54.62	272.13
South Korea	Mt. Minju	Wildlife view	45.37	50.27
South Korea	Mt. Minju	Wildlife view	45.37	56.55
Finland	Repokallio-summer	Hike, skiing	13.82	2.97
Finland	Repokallio-winter	Hike, skiing	13.82	3.42
Finland	Linnunlahti-summer	Hike, skiing	13.82	3.29
Finland	Linnunlahti-winter	Hike, skiing	13.82	2.71
Finland	Lykynlampi-summer	Hike, skiing	13.82	3.04
Finland	Lykynlampi-winter	Hike, skiing	13.82	3.23
Spain	Gran Canaria (Canary Island)	Sight see, camp, hike	34.67	17.51
Spain	Gran Canaria (Canary Island)	Sight see, camp, hike	42.14	17.26
Australia	Carnarvon Gorge NP	Camping & viewing	59.74	30.73
Canada	Nopiming	Canoe, fish, hunt, moterboat, camp	73.44	76.42
Canada	Atikaka	Canoe, fish, hunt, moterboat, camp	73.44	326.55
Canada	Whiteschell	Canoe, fish, hunt, moterboat, camp	73.44	197.28
Canada	Woodland Caribou	Canoe, fish, hunt, moterboat, camp	73.44	456.58
Canada	Foothills Model Forest	Camping	41.07	33.32
Madagascar	Beza Mahafaly Special Reserve	Wildlife viewing	54.90	99.84
Madagascar	Beza Mahafaly Special Reserve	Wildlife viewing	54.90	131.49
Costa Rica	Monteverde Cloud Forest Reserve	Campinig, sight seeing, horseback riding	36.62	193.43
Kenya	Kenya NP & Reserve	Wildlife view, Offroad drive, sightsee	26.81	76.53
UK	Forest: Brecon	Outdoor recreation	32.64	6.77
UK	Forest: Cuchan	Outdoor recreation	32.64	5.89
UK	Forest: Cheshire	Outdoor recreation	32.64	4.98
UK	Forest: Lorne	Outdoor recreation	32.64	3.75
UK	Forest: New Forest	Outdoor recreation	32.64	3.72
UK	Forest: Ruthin	Outdoor recreation	32.64	6.56
Belgium	Heverleebos & Meerdaawoud	Hiking	41.71	15.87
Belgium	Heverleebos & Meerdaawoud	Biking	28.14	12.52
Ecuador	Galapagos	Ecotourism: Sightsee, mountain climb, hiking, bird watching	42.61	387.03
Ecuador	Amazon	Ecotourism: Sightsee, mountain climb, hiking, bird watching	42.61	144.62
Madagascar	Mantadea NP	Ecotourism: sightsee, wildlife viewing	34.62	25.88
Madagascar	Mantadea NP	Ecotourism: sightsee, wildlife viewing	45.37	34.69
New Zealand	Greenstone & Caples	Big game hunt	42.75	80.71
New Zealand	Greenstone & Caples	Fishing	39.33	63.42
New Zealand	Greenstone & Caples	Trekking	30.27	39.20
New Zealand	Greenstone & Caples	Big game hunt	42.75	107.24

Annex 6.3: Continued ...

COUNTRY	SITE	ACTIVITY	WTPPRE	WTPORI
New Zealand	Greenstone & Caples	Fishing	39.33	71.49
New Zealand	Greenstone & Caples	Trekking	30.27	59.96
Malaysia	Jeram Lanang	Forest rec: hiking, camping	16.01	3.55
Malaysia	Telok Bahang	Forest rec: hiking, camping	16.01	4.76
Malaysia	Gunung Pulai	Forest rec: hiking, camping	16.01	7.27
Malaysia	Jeram Lanang	Forest rec: hiking, camping	41.07	2.64
Malaysia	Telok Bahang	Forest rec: hiking, camping	41.07	8.01
Malaysia	Gunung Pulai	Forest rec: hiking, camping	41.07	12.64

Annex 6.4

Variance of the Meta-Model Predicted WTP and Original WTP Oalues (Original WTP Values are Adjusted to PPP Conversion Factors)

Category	All Countries		High Income		Low Income	
	WTPPRE	WTPORI	WTPPRE	WTPORI	WTPPRE	WTPORI
Treatment A	230.92	4371.67	261.11	3666.15	175.06	5642.92
Treatment B	208.09	1048.71	225.21	655.9	179.53	1683.52
Treatment C	181.54	680.36	182.21	294.01	184.21	1293.25

Note: Low income = countries with per capita income below US $8,955,
High income = countries with per capita income above US $8,955.
WTPPRE = meta-model predicted WTP variance; WTPORI = original WTP variance of out of sample studies.

Annex 6.5

Variance of Meta-Model Predicted WTP and Original WTP Values (Original WTP Values Adjusted to the Ratio of PPP Based Per Capita Income)

Category	All Countries		High Income		Low Income	
	WTPPRE	WTPORI	WTPPRE	WTPORI	WTPPRE	WTPORI
Treatment D	230.92	6571.71	261.11	6155.67	175.06	7268.09
Treatment E	208.10	2286.93	225.21	1218.06	179.53	3861.23
Treatment F	181.54	1893.35	182.21	646.11	184.21	3708.74

Note: Low income = countries with per capita income below US $8,955,
High income = countries with per capita income above US $8,955.
WTPPRE = meta-model predicted WTP variance; WTPORI = original WTP variance of out of sample studies.