Introduction to Non-Market Valuation Methods and Critical Review of Their Application in the Czech Republic

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Abstract

The primary objective of the paper is to provide a summary and critical review of the non-market valuation studies that have been carried out in the Czech Republic so far. In addition to that, we also briefly review non-market valuation studies that have been applied in Poland and Hungary. In total we have identified 39 such studies carried out in these three countries. In our paper we first discuss the various approaches and methods of assessment of policy options for environmental regulation. We pay special attention to benefit-cost analysis that allows to consistently treat and compare the costs and the benefits involved by a policy in the same unit, that is money. Then the taxonomy of various valuation methods is provided and the market and non-market valuation methods are briefly described. The core part of the paper presents our summary of non-market valuation carried out in the Czech Republic. We identify a total of 13 such studies that have been carried out and five new or ongoing research activities. Most of them apply contingent valuation surveys. Our paper analyzes and characterizes all the Czech applications according to various criteria such as: research area and contingent product, method used, date of survey, research design, data collection, sampling strategy and sample size, contingent market situation, elicitation question format and treatment of protest bids, payment vehicle as well as source of funding, results and intensiveness of statistical analysis. As we compare three analyzed countries, the most examined research area in the Czech Republic is landscape amenities provided by agriculture and forestry (6 studies out of 16), whereas it is water-related benefit/damage in Poland (7/12) and Hungary (5/11). Nature conservation also presents an often considered area in Hungary (4/11). Valuation of human health does present a relatively new area, however, with the most dynamic progress in the Czech Republic (5/16). The first non-market valuation study in all the three countries was carried out in 1994. Three-quarters of all the studies have applied CVM, either exclusively or in combination with another method (30/39). We identified only six TCM, three BT and HPM applications, and one application of the ABM and CA methods.

Keywords

benefit-cost analysis, non-market valuation, contingent valuation method, travel cost method, hedonic pricing method, review

1. Introduction

During the transition period, only the costs involved by environmental regulation or implementation of the *acquis communautaire* were considered in the Czech Republic. Benefits of the regulation were, therefore, entirely omitted or briefly mentioned mostly in a qualitative way.

Where the benefits were not identified and calculated, economic optimality and efficiency could not be considered. We are also convinced that effective and efficient policy can not be enforced if there is a lack of knowledge and information about voters' preferences. Revealed or stated preferences can be useful and helpful information for current decision-making, but can also serve as a message and some indication for future policy goals and priorities.

In our paper, we would like to contribute to the debate on what kind of tools can be used for policy option assessment and ranking. Our aim is also to provide a brief summary of the Czech valuation applications and their empirical results. We focus entirely at the non-market valuation methods that are based in the mainstream economic theory and welfare economics in particular.

Although we only focus on economics and the related economic views of the issue, we are aware of there being a plenty of other valuation approaches and concepts than just those that economic theory can offer. Since our knowledge and space available for our contribution in this book are limited, however, we do not discuss the competing views of the alternative approaches. Although this paper focuses on the environmental field in particular, the methods, approaches and techniques presented can be applied to any area (e.g. education, risk assessment).

The structure of our paper is following. First, we briefly discuss reasons and tools for valuing the alternative policy options in the environmental area. Then, we describe all the possible methods that can be used for valuation of (not only environmental) benefits. A taxonomy of valuation methods follows. Then, we pay special attention to a description of the non-market valuation methods. We also briefly describe cost-based methods particularly used for valuation of damage caused by changes in environmental quality and/or quantity that complement non-market valuation methods. The next chapter opens with a review of the state–of–the–art in the valuation in the Czech Republic, including the applications of the cost-based method, valuation of marketed environmental goods and assets, uses of juridical values and expert judgment, and the benefit transfer method. The main part of Chapter 4 reviews all thirteen non-market valuation studies we have identified so far that have been carried out in the Czech Republic. All the Czech applications are analyzed and characterized according to various criteria such as research area and contingent product, method used, date of survey, research design, data collection, sampling and sample size, contingent market situation, elicitation question format and treatment of protest bids, payment vehicle, results and scope of statistical analysis. Then we conclude with the newest progress and new research activities in the field. In addition, Chapter 5 briefly reviews non-market valuation studies that have been applied in Poland and Hungary. Finally, our review and assessment are summarized.

2. Assessment of the Environmental Regulation Options

Should a policy option be taken, the social planner would try to assess, compare and rank the costs of overall possible alternative options that would be involved in reaching a certain environmental target or goal. If there are several options that are capable of reaching the same goal and if the authority wants to act rationally, the least-cost option is chosen. The funds are then used as efficiently as possible and the goal is reached ("cost-efficient approach").

The same logic can be followed if the options lead to different heterogeneous goals. **Cost-effectiveness analysis** (henceforth CEA) presents one possible option for assessing policy alternatives. CEA quantifies benefits - originally expressed in physical terms, for instance

tonnes of pollution reduced or number of bears saved - that are compared with the costs. Alternative options or projects are then ranked according to the costs per unit of benefit[1].

Cost-utility analysis (CUA) is considered to be one variant of CEA. This method is usually applied in the field of medical and public health in order to assess the cost-effectiveness of different public health interventions and projects. The aim of all CEA variants is identical: the alternative options are prioritized according to their per unit costs of benefit or utility. The scope of analysis, however, can differ: the costs under examination can cover private and/or public financial costs, or even economic costs such as impacts on employment and economic growth; analysis can consider only one benefit or only direct benefits (the recreational and production function of forest) or even indirect benefits (retention capacity and soil protective functions).

There are, however, two serious problems with the application of CEA:

- what the benefits are really worth, and
- how to assess heterogeneous benefits expressed in different physical units that have been attained by a certain policy.

CEA is applied when benefits are impossible to estimate in monetary terms and/or it is considered – for any reason – that it is immoral or unethical to attach a monetary value to a certain good, such as human health or a bear's life. Even if the social planner is capable of ranking and, thus, choosing the best option, it is still not clear whether the choice is optimal and socially desirable from the economic point of view. In other words, even if we are able to find the least-cost option, we cannot assess whether the amount of costs involved can be justified by the attained benefits, i.e., whether the benefits expressed in monetary terms are not too small for the potential consumer(s).

Moreover, there is no doubt that the environmental regulation leads - in many cases – not to one but to many co-benefits. In practice, environmental policy assumes to reach those synergic and complementary (environmental) benefits by certain regulation. How then should the social planner assess the alternative policy options if more heterogeneous benefits can be reached? **Multi-criteria assessment** (MCA) represents one of the approaches. MCA tries to compare various heterogeneous environmental impacts affected by policy mostly based on an expert judgment. Economists do not, however, favor this approach mostly due to its arbitrariness, and lack of theoretical foundations. Ranking of various criteria is based on the preferences of experts and specialists participating in MCA (usually about ten to twenty persons). The preferences are determined by the best knowledge and practical experience of those that know the problem better than a representative agent. Another option for treating heterogeneous benefits is the benefit costs analysis.

Benefit cost analysis (BCA)[2] compares the costs and benefits of a project or policy option expressed in the common unit, that is money. The choice is, therefore, made independently of

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[1] "Cost-effectiveness analysis" suggests choose the option with minimum costs per unit of benefit (expressed in physical terms). On the contrary, "cost-efficiency analysis" maximizes benefits per unit of involved costs. Thus, "costs-effectiveness analysis" and "cost-efficiency analysis" are reverse to each other, but lead to the same rank.

[2] The term "benefit cost analysis" (with the acronym BCA) is used in the USA, while "cost-benefit analysis" (CBA) is used in the continent.

the decisions of the experts and specialists as used in MCA. Application of BCA, thus, can significantly contribute to solving the two above mentioned problems related to CEA.

BCA can be applied in the valuation of environmental degradation as well as of environmental improvement, the change in quality and in quantity. BCA can, in principle, cover many environmental issues such as:

- provision of certain (new) environmental goods or services,
- improvement of certain environmental goods or services,
- disappearance of certain environmental goods or services that used to be provided, and
- degradation of certain environmental goods or services.

If the social planner tries to apply BCA, there is a variety of possible methods that can fulfil his/her choice. Monetary values derived from the conventional market using market prices can provide punctual magnitude of the value. On the other hand, the market price only provides the lower bound of the willingness-to-pay. Welfare or loss related to non-market goods and services - the equivalent or compensating surplus in economic terms - can be estimated only by the non-market valuation method.

BCA is very easy to apply and its results are understandable to the decision maker. Variants of suggested projects or policy alternatives can be easily ranked and, thus, prioritized. The clear advantage of BCA is the incorporation of the time factor in the analysis. This is relevant particularly for environmental projects due to their impacts lasting over very long periods of time (e.g. impacts due to climate change caused by GHG emissions). However, one should carefully consider the time factor, particularly when deciding which discount factor to use (e.g. a market discount rate versus a marginal rate of time preference, or linear versus hyperbolic discounting)[3]. Another advantage of BCA lies in the fact that BCA can be incorporated within the sensitive analysis of any assessment.

Benefits for which a monetary value is derived should always arise from a change in agents' utility or welfare[4]. The benefit, or loss, should be valued by deriving the marginal willingness-to-pay (WTP) or the marginal willingness-to-accept (WTA) for the good under examination. Then we can derive the following, as suggested by Markandya et al. (2002) or Pearce and Turner (1990):

- WTP for certain (environmental) improvement,
- WTA to forego certain (environmental) improvement,
- WTP to avoid or prevent certain (environmental) degradation/damage,
- WTA for certain (environmental) degradation/damage.

Methodological individualism is the fundamental paradigm followed in valuing (environmental) benefits. Economic theory cannot provide any support for the approach that tries to derive a monetary value without being based on a subjective theory of value and individual preferences. This approach corresponds to the anthropocentric view of value. On the contrary, the mainstream economic theory cannot provide any technique to value environmental goods and services following an eco- or bio-centric view. Moreover, economic

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[3] ExternE method and model FUND apply 0%, 1%, and 3% discount rate (see Tol and Downing 2000; Downing and Watkiss 2004, or Melichar et al. 2004 for the review).

[4] This holds with neoclassical economics, particularly welfare economic theory.

theory, and non-market valuation in particular, cannot provide any tool or technique in order to express a monetary value of something that is not perceived by an individual. Environmental benefits and losses can be associated with either marketed or non-marketed goods. Their valuation represents a scientific discipline nowadays widely and dynamically spreading within environmental economics supported by other disciplines such as sociology, psychology, ecology, epidemiology, or toxicology. All the possible methods for valuation of both are described in the next chapter.

3. Methods for Valuing Environmental Goods

3.1 Taxonomy of Valuation Methods

In principle, we can identify several groups of approaches for deriving environmental degradation, damage or benefits in monetary terms. These approaches can be based on:

- market, or quasi-market prices,
- arbitrary monetary values set by legislation (juridical value),
- expert opinion or judgment, or
- eliciting WTP or WTA by applying some of the non-market valuation methods.

Juridical values and approaches based on expert judgment are not discussed in our paper. We only deal with the market and non-market valuation methods.

We summarize and compare altogether five different taxonomies of market and non-market valuation methods:

1. Mitchell and Carson (1989) classify the methods based on the source of data. First, the methods are portioned according to whether they yield monetary values directly or indirectly. Then, if the values are derived directly, they classify whether the data come from observation of people acting in the market (revealed preferences) or from people's responses to hypothetical questions concerning their willingness to pay (stated preferences);
2. Munasinghe (1993) distinguishes among approaches according to the type of market from which the value is derived. The monetary value can be thus derived by looking at (i) the conventional market; (ii) the implicit market; or (iii) a constructed market;
3. Dixon et al. (1994) distinguish between techniques that are based on a measurement of the physical relationship between the cause and the effect (also called cost-based methods), and techniques that are based on observed behavior, specifically on revealed or stated preferences of consumers;
4. SEEA-2003 (UN et al. 2003) distinguishes between the cost-based and damage-based valuation methods. Similarly to the above mentioned classifications, damage-based valuation methods are further portioned into methods based on revealed or stated preferences (for detailed information about SEEA-2003 classification see Appendix 1);
5. Pearce and Howarth (2000) follow a different logic. They start with total economic value, which is then portioned into use and non-use values. Then various methods are sorted including their ability to provide a monetary value for a certain value. The dose-response (concentration/exposure-response) function or production function need

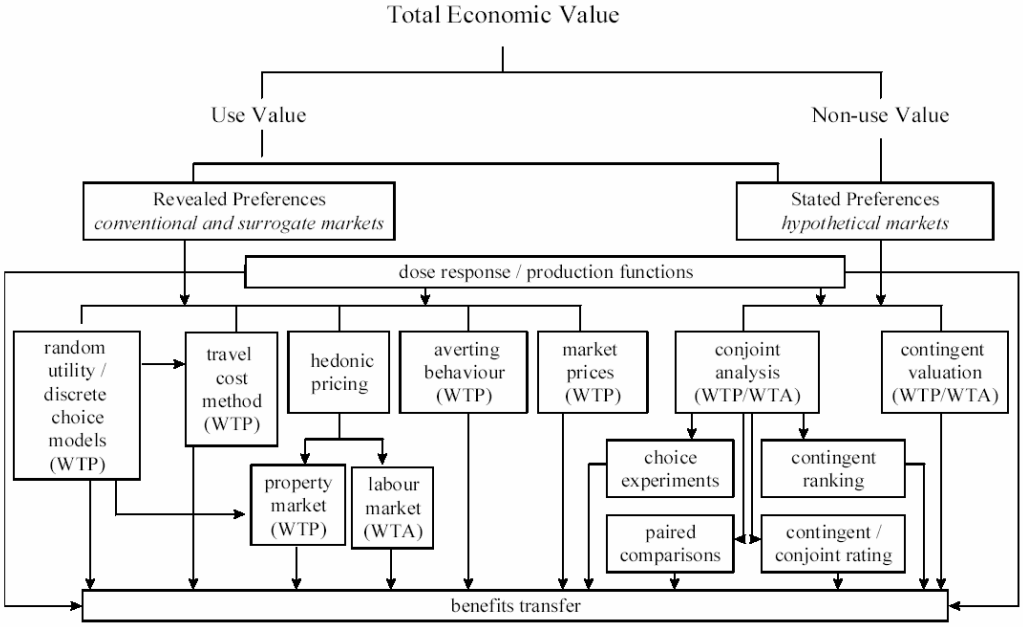
to be derived and thus known if one wants to attach a monetary value to any environmental benefit whichever method is then applied (see Figure 1).

Figure 1: Taxonomy of valuation methods and techniques.

Mitchell-Carson (1989)	**INDIRECT METHODS**	**DIRECT METHODS**	
	Dose-response	**Revealed Preference**	**Stated Preference**
	Change in Input/Output Cost-of-illness Replacement Cost	Hedonic analysis Travel Costs Averting behavior	Contingent Valuation
Munasinghe (1993)	**CONVENTIONAL MARKETS**	**IMPLICIT MARKETS**	**CONSTRUCTED MARKETS**
	Change in Input/Output Cost-of-illness Replacement Cost Averting Expenditures	Hedonic analysis Travel Costs	Contingent Valuation
Dixon-Scura-Carpenter-Sherman (1994)	**PHYSICAL LINKAGES**	**BEHAVIORAL LINKAGES**	
		Revealed Preference	**Stated Preference**
	Change in Input/Output Cost-of-illness Replacement Cost	Hedonic analysis Travel Costs Averting Expenditure	Contingent Valuation
UN-EC-IMF-OECD-WB (2003)	**COST-BASED**	**BENEFIT/DAMAGE-BASED**	
		Revealed Preference	**Stated Preference**
	Avoidance costs - structural adjustment - abatement costs Restoration costs	Direct - Market prices Indirect - Hedonic Pricing - Travel Cost	Direct - Contingent Valuation Indirect - Conjoint Analysis
Pearce-Howarth (2000)		**Revealed Preference (conventional and surrogate markets)**	**Stated Preference (hypothetical markets)**
		Market Prices Random Utility / Discrete Choice Models Travel Costs Hedonic Pricing - property market - labor market Averting Behavior	Contingent Valuation Conjoint Analysis - contingent ranking - choice experiments - paired comparisons

Source: First three parts taken from Markandya (2004).

Figure 2: Typology of valuation methods and total economic value.



Note: Pearce and Howart (2000); we are grateful to Stanislav Kutáček of the Czech Transport Research Center for providing the chart; the chart also cited in Bateman et al. (2002): 30.

The non-market valuation method aims at deriving the monetary value of non-market goods or services by following neoclassical economics. It represents a relatively new scientific discipline nowadays widely spread within environmental economics supported by other disciplines such as sociology and psychology. Non-market valuation methods that we are particularly concerned with in this paper and the book are the following:

- hedonic pricing method (HPM),
- travel costs method (TCM),
- contingent valuation method (CVM),
- conjoint analysis (CA),
- averting expenditures or averting behavior method (ABM).

Looking at the Figure 1, a technique belongs to the group of non-market valuation methods:

(i) if a monetary value can be yielded directly (Mitchell and Carson 1989),

(ii) if the value is not derived from conventional, but rather from implicit or constructed markets (Munasinghe 1993),

(iii) if the value is based on behavioral linkages not physical ones (Dixon et al. 1994),

(iv) if the valuation is done using a damage/benefits-based method not a cost-based method (UN et al. 2003).

Non-market valuation methods can be further divided according to their capacity of estimating WTP and/or WTA (see Figure 2). Only CVM and CA are capable of deriving a monetary value from both WTP and WTA. All the methods based on revealed preferences, except hedonic pricing applied to a labor market, such as TCM and ABM, can only derive value from WTP; on the contrary, hedonic pricing for a labor market can only use WTA. There is huge theoretical and empirical research comparing the values derived by either WTP or WTA; WTA provides higher values than WTP (even two to five times higher depending on the product and method).

Application of non-market valuation methods requires following and linking various disciplines *inter alia* economic, sociological, and econometrical, supported by sufficient amount of time and financial resources related to gathering and analysis of data.

3.2 Brief Description of Valuation Methods

In this sub-chapter, we briefly describe various valuation methods. First, valuation methods using market or quasi-market prices are described, then non-market valuation methods follow.

A. Brief Description of Market Valuation Methods

All of these methods use information from conventional markets, are based on physical linkages, and derive value indirectly using various statistical sources and the dose-response function (see the taxonomy of methods in Figure 1).

Change in the Output or Input of a Marketed Good

The method can be used when an environmental function affects the production and/or cost function of a certain good. In the **productivity change method** (PCM), change in an environmental attribute leads to changes in the output of the marketed good. For instance, a decrease in water quality due to pollution can have an adverse impact on fish stock in terms of quantity and/or quality. Damage due to water pollution can be estimated as a loss of fish production or involved incremental costs spent in order to mitigate the adverse effect of water pollution on the fish stock. Another example is a decrease in the output of roundwood and berries provided by forests due to air pollution. A special case of PCM is the **substitute cost method** in which the money saved using environmental goods (e.g. forage to feed livestock) instead of a priced input (sorghum) is a measure of the benefits of a certain environmental good or service.

The Production Loss Method: Human Capital Approach (HCA)

In principle, HCA is a special case of the productivity change method applied to a very special good that is the workforce or a human being. This method is based on a macroeconomic vision of the role of the individual as an agent contributing to the activity of the economic system. The mortality effect is then valued through his/her productive contribution. The value of preventing a fatality at a given time is equal to the future productive loss evaluated as the discounted sum of the earnings that the individual would have otherwise earned. Although there are many problems related to this approach not

discussed here, we would just note that this method is inconsistent with principles of welfare economics by not taking into account agents' preferences. Due to considering only the productive aspect of the individual, this method underestimates the value of life compared with estimates derived from WTP approaches.

The Loss of Consumption Method

Another method trying to derive a monetary value for statistical life or mortality effect is the loss of consumption method. This approach, again, is based on a macroeconomic vision of any individual as a consumer and if there is a case of premature death, the loss of consumption possibilities is estimated. The estimation of value of a statistical life or related mortality effects is mostly based on households' final consumption; see OECD (2002) for more discussion on both above methods.

Cost-of-illness (COI)

The cost-of-illness method is applied in monetary valuation of morbidity effects within health impact assessment. COI measures the pure economic benefit associated with a change in health status that consists of i) treatment costs and ii) loss of productivity.

Treatment costs – related to relevant health end-points – can be spent either by a public health system, private health insurance system and/or patients. Generally, the expenses by public health insurance systems are obtained from official statistical records. In addition, off-pocket expenses related to analyzed illness spent by the patient him/herself should be estimated (for the results, see e.g. CAFE CBA methodology in Holland et al. (2004); Bickel et al. (2000); or Melichar et al. (2004)).

Loss of productivity can be, in principle, calculated by two approaches: i) costs of absenteeism as has been followed for instance by CBI (1998), or ii) using data on average national labor productivity or salary (Bickel et al. 2000; CSERGE et al. 1999). The first approach is more methodologically sound and better for modeling, however, also extremely time and cost intensive. Costs of absenteeism consist of direct and indirect costs. Direct costs include the salary costs of absent individuals, replacement or other costs due e.g. to employment of temporary staff or additional overtime, lost service and production time, as well as indirect costs of absence such as lower consumer satisfaction, poorer quality of products or services leading to a loss of future business. The second approach – based on average labor productivity or salary – can provide a reasonable proxy for loss productivity.

Replacement Costs

The method focuses on costs spent in order to abate, restore or replace a previously damaged marketed or non-marketed good due to degradation of a certain environmental quality. One example of the method can be found in Seják, Dejmal et al. (2003), where the so-called Hessian method was developed and applied to the Czech Republic. Seják's method is representative of the method based on expert judgment and is briefly described in Chapter 4 (see also the paper by Seják in this book).

B. Brief Description of Non-Market Valuation Methods

There are two groups of non-market valuation methods: those based on revealed or stated preferences. Revealed preference methods can be divided into HPM and household production function approach (Kolstad 2002). This approach consists of TCM and ABM. Stated preference methods include CVM and CA.

Averting Behavior Method

The averting expenditures or averting behavior method uses revealed preferences on conventional markets and is based on behavioral linkages (see the taxonomy of methods in Figure 1). The approach assesses the value of non-marketed goods through the real expenses spent by households or producers for a certain marketed goods or service in order to (based on Markandya 2004):

- prevent an environmental impact, or
- prevent a utility loss by environmental degradation, or
- change their behavior to acquire greater environmental quality.

The potential adverse impacts can be avoided in any of the following three ways:

- buying durable goods (e.g. double-glassed windows, water filters or purification systems),
- buying non-durable goods such as bottled water (as a substitute for tap water of degraded quality),
- changing routines to avoid exposure (e.g. boiling water for cooking or drinking).

The motive for the expenditures can be described as follows: a household or producer wishes to sustain his/her welfare unchanged after a change in environmental quality due to e. g. air pollution or noise. These expenditures correct certain harms done by the degradation of environmental quality or quantity. Averting expenditures can rarely eliminate the impacts due to environmental degradation completely. Therefore, in the case of pollution, one should sum up averting expenditures and residual pollution costs in order to derive the total costs of pollution (see also the paper by Markandya in this book or Markandya et al. 2002).

Averting expenditures can also be called preventive, defensive or regrettable expenditures (see a discussion of the link with national accounts in UN et al. (2003), Chapter 10; see a review of empirical and conceptual issues in Ščasný et al. (2002)). Except for Munasinghe (1993), all the below cited authors rank the averting expenditures to the same group as the methods based on revealed preferences such as HPM and TCM.

Hedonic Pricing Method

The basic assumption of HPM is that the market value of a good is affected by many attributes, including the environmental quality. If one is able to isolate the particular effects of specific environmental attributes on the price, it is possible to derive an implicit or surrogate price of the attribute. The method consists of two steps: first, hedonic price function is derived from real observations (the relation between a real market price and the quality of the environmental attribute is estimated) and the implicit price function is derived from the hedonic price function given by the first derivative of the house price function with respect to

the environmental attribute; second, based on the estimated implicit price function, the inverse demand function is derived (in that implicit price is regressed on various observed socio-economic and environmental variables); finally, consumer surplus can be calculated from the inverse demand function.

There are two widely used applications of HPM. The first one presents HPM application to a property market. The idea is that the price of a house in a polluted area is usually lower, other parameters remaining the same, than the price of a house located in a better environment. Simply speaking, the price difference can be then expressed as a value of the difference in the environment quality (see e.g. Hidano 2002). The second case presents an application of HPM to a labor market. Similarly to the property value approach, a statistical relationship between the wage rate and all the factors – including the environmental occupational risks, that potentially influence earnings is established, tested, and analyzed. Then the value of a statistical life is estimated (Viscusi 1993). A well-functioning and effective market – such as the labor or housing market – is a necessary pre-condition for HPM application in order to get appropriate estimates.

Travel Costs Method

The method is commonly applied to valuing site-specific goods related to provision of a certain environmental resource. TCM is mostly applied to valuing the recreational value of forest, countryside, or whatever landscape. TCM can, however, provide a value for the direct use value and is not appropriate for use in valuing the bequest or existence value of nature or individual species. The basic approach is to elicit data on visitors' total expenditures spent in order to visit a site, including the entrance fee, travel costs and time spent traveling. Then, their demand curve for the service provided by the site is derived. The travel costs needed to reach the site can be considered the implicit or the surrogate price of the visit.

There are two models of the travel costs method[5]:

- **zonal travel costs model** (ZTCM) divides the recreational visitors into the zones they came from and currently live in. For each zone, corresponding zonal travel costs related to visiting the site and zonal socio-economic characteristics are estimated. The average visit rate for each zone is calculated. A so-called direct demand recreational curve is derived in the next step by regressing the trip generating function (the visit rate on travel costs and other variables):

$$V_{hj} / N_h = f(TC_{hj}, SOC_h, SUB_h)$$

where

V_{hj} / N_h -is the participation rate for the zone h (visits per capita to the site j),

TC_{hj} - is the costs of travel from the zone h to the site j,

SOC_h - is a vector of the socio-economic characteristics of the zone h,

[5] For the models description see e.g. Markandya et al. 2002; or Garrod and Willis 1999.

SUB_h - is a vector of the substitute recreational site characteristics for the individuals from the zone *h*.

Then, aggregated consumer surplus for each zone is estimated (average consumer surplus[6] recalculated per year and multiplied by the number of inhabitants living in the zone). Total consumer surplus equals the sum of aggregated zonal consumer surpluses.

- **individual travel costs model** (ITCM) relates the annual visits made by an individual to the related travel costs. Visits made by an individual are also determined by other factors such as income, availability of substitute sites, perception of environmental characteristics, recreational experience and other socio-economic characteristics of his/her household. Then, the individual demand function is constructed in the following way:

$$V_{ij} = f(TC_{ij}, T_{ij}, Q_j, SUB_j, INC_i)$$

where

V_{ij} - is the number of visits made by the individual *i* to the site *j*,

TC_{ij} - is the travel costs incurred by the individual *i* when visiting the site *j*,

T_{ij} - is the time costs incurred by the individual *i* when visiting the site *j*,

Q_j - is a vector of the perceived qualities of the recreational site *j*,

SUB_j - is a vector of the characteristics of available substitute sites,

INC_i - is the household income of the individual *i*.

The demand curve for each individual is integrated between the actual travel costs and the choke price. Thus, the individual annual consumer surplus is expressed. Multiplying the individual annual consumer surplus by the number of visitors per year, we obtain the total annual consumer surplus for the examined site.

There is another classification of TC methods provided for instance by Parsons (2003) that distinguishes a **single site model** and a **random utility model**:

- **single site model** (SSM) allows to value the recreational function of an entire area. It can be used, for instance, if one wishes to obtain the value of closing the site due to contamination. The recreational demand function is constructed as a function where the number of visits is dependent on the trip costs and socio-economic variables,

[6] Average consumer surplus is calculated (zone by zone) estimating the area under demand curve between average travel costs and choke price (the price that leads to zero visits).

substitute sites, and other observed variables. Data are collected directly using an on-site or off-site sampling strategy;

- **random utility model** (RUM) considers the consumer choice of a visitor for a recreational trip. RUM aims at a benefit related to the change in a site's environmental characteristics (not the value of the site as a whole as in SSM). On the contrary to the single site model, where the dependent variable is the number of visits over the analyzed period, it is the site utility (or the site) in RUM. Site utility is a function of travel costs and characteristics of the site. While the time frame for the single site model is a season, the time frame for the RUM model is a chosen occasion (e.g. one week or the last five months). The sampling strategy in the RUM model could be only an off-site strategy.

Contingent Valuation Method

CVM introduces hypothetical situations to a (representative) sample of a population presented in a questionnaire to elicit willingness to pay or willingness to accept compensation for a contingent product. In principle, a CVM survey can consist of three parts: first, basic information about the contingent product is offered to the respondent; then the WTP/WTA is elicited; and finally, the socio-economic characteristics or respondent attitudes are examined. Average (mean and median) WTP/WTA is calculated that could be weighted in order to get the representative value for the entire affected population.

The value of WTP/WTA can be elicited in several formats (see e.g. Bateman et al. (2002) for a description of the formats):

- open-ended question,
- bidding game,
- payment card or ladder approaches,
- single-bounded dichotomous choice or referendum methods,
- one and a half dichotomous choice,
- double-bounded dichotomous choice,
- randomized card sorting procedure.

In principle, all the formats can be followed-up several times, except the payment card and referendum methods.

There are several sources of possible biases that one should carefully consider while designing and applying the CVM:

- **strategic and protest bias** – an individual can freeride and understate the value, act strategically and overstate the bids (strategic bidding), give a zero or extremely large bid because he/she does not accept the contingent situation and valuation method itself (protest bidding);

- **design bias** – the way the questionnaire is designed, the contingent situation and product are presented, and the elicitation format is developed can affect the outcome. There are several sources for potential cautions:

- anchoring bias is a mis-statement of the WTP/WTA due to tying the respondent's value judgment to a known or presumed reference point, e.g. existing taxes or charges, or misunderstood hints in the scenario description,
- starting point bias is one form of the anchoring effect that cautions against the unintended effect that is involved by the magnitude of the offered starting bid; relevant for example for the dichotomous choice question format,
- context (information) bias relates to the undesirable effect due to the nature or context of the problem (e.g. co-benefit from environmental quality improvement),
- the ordering effect marks the effect on payment that is caused by the order in which options are presented to the individual,
- the framing effect takes place when the way the options, information or questions are framed can change the response, e.g. by involving emotions or hesitancy;

- **payment vehicle** represents the way in which the payment will be likely made, for instance willingness to pay can be "in reality" paid through:
  - increased taxes,
  - contributions to special public funds,
  - reduction in household expenditures or savings due to increased expenditures for the valuated good,
  - increased price(s) of certain goods, or
  - no concrete payment vehicle is explicitly mentioned (abstract form).

  The format of the payment vehicle can encourage the respondent to pay less or even nothing for a contingent product (for instance, an increase in taxes or contribution to the fund), even if he/she would be willing to pay a certain positive amount if a no-tax vehicle were considered. In this way, a protest bid is declared;

- **availability bias** is related to the probability of an event (e.g. avalanche), frequency or risks, class, or appearance; for instance, various types of death (e.g. caused by car accident) that are included and described in the contingent situation and then valued;

- **the embedding problem** occurs when the respondents are willing to pay almost the same for the inclusive good (one part of the lake as well as for the entire lake) and/or for different quantities of the same good (100 birds and a million of birds). This can be corrected by a scope or scale test;

- **hypothetical bias**, or operational bias, is related to the rate of suppositionality and refers to mis-specifications of the true WTP/WTA due to the fact that the individual is not acting in a real context;

- **compliance bias** – the respondent may respond in order to try to please the interviewer.

The number of CVM applications constitutes an enormous body of studies. The latest review of the studies covering the last fifty years is provided e.g. in Smith (2004); a review of Czech, Polish and Hungarian CVM applications is offered in the next chapter.

A great portion of criticism on the contingent valuation method comes from the hypothetical market on which people face a hypothetical situation and make consumer choices without real money. This problem can be overcome by field experiments or laboratory experiments.

In the first case, a **field experiment**, a real market is constructed by the experimenter in an area where the market has not previously existed. Examples of such markets could be a market in which goods and services are allocated on the basis of a lottery or a first-come basis. In order to understand the consumer behavior in a better way, the experimenter constructs an experimental market in which originally allocated goods or services are traded by the experiment participants. This type of experimental market can usually be built up in a situation where governmental regulations prevent a market with certain goods from operating (e.g. hunting or fishing permits).

The second option for reducing the potential biases related to the hypothetical framework of CVM is to carry out **laboratory experiments**. In practice, a group of people makes real consumer decisions based on real money. The experimenter introduces a certain type of good or bad and then the consumers realize real market exchanges.

As a matter of fact, experiments do not provide estimates of a certain type of good or bad but rather, they test theoretical concepts and analyze consumer behavior under regulated conditions. Constructing experimental markets allows, in particular, measuring disparities between the WTP to obtain a good and the WTA to give up a good (Kolstad 2002).

Conjoint Analysis

These valuation methods do not directly ask people to state their values in monetary terms. Instead, values are inferred from the hypothetical choices or trade-offs that people make. SEEA-2003 (UN et al. 2003) describes conjoint analysis as a method where the respondent is asked to state a preference between one group of environmental services or characteristics at a given price or costs and another group of environmental characteristics at a different price or costs. Several approaches of conjoint analysis can be used such as choice experiments, contingent ranking, paired comparison, contingent conjoint ranking or various similar techniques using choices, ranks or matches (see Hanemann and Kanninen 1996).

Benefit Transfer

The benefit transfer technique can also be explored in order to attach a monetary value to environmental damage or whatever benefit. Benefit transfer is not a specific valuation method which would generate a monetary value itself. Benefits transfer is rather a method that estimates economic values for non-market goods and services by transferring available valuation information from original studies already completed to a policy site where monetary values are required. Benefit transfer can be done by (see Bateman et al. 2004 or paper by Navrud in this Book):

- value transfer (using an exchange rate or purchasing power parity),
- benefit transfer function, or
- meta-analysis.

Now it is time to discuss the state of the art of non-market valuation and its applications in the Czech Republic.

4. Application of Non-Market Valuation Methods in the Czech Republic

4.1. Czech history of valuing the environment

The history in valuation of non-marketed goods, especially environmental benefits and damage, is relatively short. In fact, it began in 1994. Although we can identify hundreds of studies on evaluation and mostly qualitative assessment of various environmental phenomena, there have only been about ten research projects with a specific focus on the estimation of the monetary values for certain non-marketed environmental goods and services. There is, however, no reason for sorrows and pessimism at all. There are several fruitful research projects that address methodology and apply relevant techniques with a great dose of enthusiasm, erudition and even professional passion. But let us start at the start.

Before the Velvet Revolution – that is, November 17th, 1989 – no non-market valuation technique had been applied in the Czech Republic. In the 1970s and 1980s, the valuation of environmental degradation or amenities was not a research priority in the then Czechoslovakia. However, several attempts were performed in order to assess environmental damage on the national level. The so-called top-down approach[7] dominated the valuation of environmental damage.

Damage associated with degradation of the environment was first quantified at the beginning of the 1970s. This research - based on the top-down approach - was led by Voráček (1970). Environmental damage for the whole Czechoslovakia was quantified at CZK 4.5 billion in 1970, equaling 1.4% of the national income[8]. The application, however, suffered from many methodological shortages. Moreover, not all damage was covered. That is why the valuation was incomplete and the total value of the damage was underestimated.

A further attempt at a valuation of environmental damage was made 12 years later, in 1982, again by a team led by Voráček (1982). This time the value of damage for the whole Czechoslovakia for the year 1980 was estimated at CZK 35 billion, that is around 7% of its national income. Similarly to the first case, not all environmental damage was examined. Particularly, items such as morbidity impacts due to air pollution and traffic noise, impacts due to greenhouse gases, NO_X and chlorofluorocarbons, were not included in Voráček's 1982 valuation.

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[7] The "top-down" approach expresses total damage in monetary terms for the entire economy, first. Then all relevant pollutants and emissions which cause environmental damages are quantified and weighted according to relative toxicity of particular pollutant. Third, the total damage is disaggregated among all economic sectors and particular sources of pollution. On the contrary, the "bottom-up" approach, allows us to consider in the analysis local conditions of particular source of pollution, specific technological parameters and also spatial and time distribution of damage. The site and time specific damage can be further extrapolated and adjusted on similar technologies and aggregated for the selected sector or the entire economy.

[8] Data on national income of Czechoslovak Socialistic Republic for the years 1970 and 1980 are based on FSU (1985).

After 1989, several research projects and activities have been conducted by Czech research teams with the intention to express a monetary value of specific environmental change or damage. Some of them are particularly worth mentioning. The valuation of various functions provided by forest is the most developed area. Several competing approaches to calculating the total societal value provided by forest can be identified. The most interesting approach to forestry valuation has been developed by a team at the Czech Agriculture University in Prague (led by Pulkráb and Šišák), combining several valuation methods such as the cost-based approach, expert judgment and non-market valuation method (see e.g. Šišák et al. 2002).

Particular attention should be also paid to the VaV/320/1/97 Project "Quantification of environmental damage and possibilities for its rational internalization" funded by the Czech Ministry of the Environment in 1999. Under CUEC coordination (see Štěpánek and Moldan (1999) for a review), more than ten researchers from various Czech institutions carried out studies on the valuation of damage in various environmental fields: soil and agriculture yield, old industrial burdens, surface and ground water, forest ecosystems, air quality, radiation, coal mining, and quarrying for cement limestone, gravel and stone. A legislative analysis of the damage and a review of valuation methods were also compiled within this project series. Unfortunately, no unified method was applied in all of the fields and the cost-based approach was mostly only explored and marketed goods were considered. No detailed quantification was carried out for non-market goods and services, moreover, no consistent recommendation on how to tackle them was provided.

The next group of valuation methods represents the studies that use **market prices** for valuation of environmental damage or benefits. For example Šišák (1997, 2004) estimates the benefits provided by forest in the form of roundwood, mushrooms, berries, and pharmaceutical plants by using market prices of the relevant goods. He found that the volume and monetary value of picked berries and other non-productive produce provided by relatively heavily polluted forest is higher that the volume and the value related to less polluted forest. Actually, the impact of air pollution on this form of forest produce is not further analyzed or tested.

Market prices are also used for estimation of environmental damage in various fields by using avoidance, restoration or maintenance costs. For example, hydric and soil protective services provided by forest and forestry were estimated by Šišák et al. (2002); damage to buildings and materials due to airborne pollution was calculated by Knotková et al. (1997)[9]. Moreover, the cost-of-illness approach was applied in 2004 in order to calculate the treatment costs related to respiratory and cardiovascular diseases that can be caused by airborne pollution (Máca and Ščasný 2004; Melichar et al. 2004). Another example of application of the costs-based approach is a study on the derivation of curves of marginal abatement costs for NOx and SOx emissions for the Czech Republic[10].

Valuation of environmental assets, particularly of the value of resource stock and depletion, was undertaken by Ščasný (2001; 2004) which applies the SEEA-2003 framework (UN et al.

[9] See also Knotková et Kreislová (2004), the updated costs are in Melichar et al. (2004).

[10] Costs curves were derived by for example SEVEn within the project "Natural resources and Environmental Accounting in the Czech Republic" funded by PHARE in 1999; see Kolár et O'Connor (2000).

2003) to accounting for subsoil assets and calculation of resource rent in the Czech Republic. This approach will not be discussed further.

Juridical values have been used in, *inter alia*, valuation of soil degradation by Němec (1999), of damage to forest (see Ministry of Agriculture 1999) and damage to agricultural production (Ministry of Agriculture 1992; a brief review also in Melichar et al. 2004). Another case is the setting of juridical values for fatal and non-fatal mortality and morbidity effects (e.g. Atomic Law 1997; Labor Act 1967).

Expert judgment has been applied mostly in valuation of non-productive functions of forestry in the Czech Republic (see Melichar et al. 2004 for a brief review).

Although the team led by Šišák conducted a three-step CV survey in 1994-1995 (see below), Šišák et al. (2002) decided to value two functions: the health-hygienic (including recreational and leisure) and cultural-educational functions, taking the expert judgment approach. The value was based on a comparison of the socio-economic importance of overall forest and its marketed counterpart. Based on experts' judgments, the ratios of 0.33, or 0.28 respectively, were derived for overall marketed sales. The health-hygienic function was valued by 81 €/ha if considering the yearly marketed value of production, or 4,060 €/ha if considering the capitalized value of the forest. The cultural-educational function was valued lower at 69 €/ha, or 3,440 €/ha respectively.

Vyskot et al. (2003) calculated the societal value of forestry by deriving the real potential and real effect of various forest functions that are weighted by a so-called "social urgency factor". Experts compared ecological-stabilization, hydrologic, soil protective, social-recreational and health-hygienic function on the one hand with the bio-productive function on the other hand. The societal value of forest is then estimated at a range of millions of CZK per hectare (30,000 – 300,000 € per hectare). The Czech juridical practice in calculating monetary compensation related to damage to forestry and illegally cut trees is based on a guideline and method provided by Vyskot et al. (2003).

The Czech application of the so-called Hessian method – applied by Seják, Dejmal, et al. (2003) – is another example that tries to derive monetary value of ecological functions of biotopes and ecosystems. The valuation of relevant biotopes combines an expert evaluation using a ranking method of weighting eight ecological criteria done by ecologists with the replacement costs method. For each biotope, the replacement cost per hectare is identified using information from real past projects in the area of nature protection. The monetary values for forest biotopes are comparable with the results provided by the method of Vyskot et al. (2003); see the paper by Seják in this book for a detailed description of the method and its results.

The benefit transfer method was also applied in order to provide at least a proxy for the monetary value of environmental damage or benefits induced by policy. One example is the transfer of external cost values estimated for the EU-15 countries using the ExternE method (European Commission 1995) under two research projects funded by the Czech Ministry of the Environment in the period of 1998-2000 (see R&D 320/2/98 and R&D 320/1/99). Values were transferred using the exchange rate and purchasing power parity. We should, however, underline that this does not represent typical benefit transfer because the entire impact pathway was transferred. Because the externality is strongly site, time, and technology-specific, the transferability of externality estimations is very limited and the values cannot provide sufficient information for policy and further economic considerations.

To our best knowledge, no more sophisticated realistic benefit transfer technique, such as the use of the transfer benefit function or meta-analysis, has so far been applied. [11]

We have identified much fewer applications of the **non-market valuation method** in the Czech Republic in comparison with applications of the methods just described above. In total, we found 13 non-market valuation studies, mainly CVM, that have been carried out so far. Then there are another three ongoing research projects. These studies cover a variety of environmental damage and benefits including impacts on human health or benefits provided by forest services and landscape amenities. Discussion concerning experimental economics in the environmental area has also been gaining momentum since 2004 (see the Czech manual in Klusák, Melichar, Šauer, Prchal 2005).

4.2. A Brief Review of the Czech Non-Narket Valuation Studies

This part reviews and discusses all the non-market valuation studies that have been conducted – to our knowledge – in the Czech Republic.

In order to make our review more reader-friendly, we have summarized our description of all the identified studies in tables attached in the Appendix 2. Table 1 presents a short overview of the non-market valuation studies which have been realized in the Czech Republic since the beginning of the 1990s. This table also shows the authors, the valuation techniques applied and the research areas of the respective studies. Table 2 briefly describes non-market valuation study. Table 3 then characterizes each study by the design of the research survey, sampling strategy, type of data collection and sample size. Table 4 describes the contingent product, payment vehicle used and elicitation question format. Next, Table 5 presents results of the studies and our remarks mostly related to the environmental context or attitudes tested in the questionnaire. All of these study characteristics are discussed and analyzed in the text which follows here. For simplicity and clarity, we use an acronym for each of the studies.

Research: When and What?

We can identify two waves in the application of the non-market valuation method in the Czech Republic. The first of them is marked by the years 1994 (when the first method was applied) and 1996. During that period six studies were carried out. The second wave started in 2000 and six more non-market valuation studies have been carried out, while another three are ongoing.

The first non-market valuation study was applied in 1994 to the industrialized city of Děčín which is situated in Northwest Bohemia (FUEL). The benefits of household conversion from brown coal to natural gas were estimated using the contingent valuation method (Šauer et al. 1996). In 1995, the other three CVM studies were carried out. The first of these CVM applications (AIR&WATER) measured the benefits of households from air pollution reduction and drinking water quality improvement (Tošovská 1996). The second study (LIMESTONE) valuated the benefits provided by landscape and biodiversity that could be potentially destroyed by quarrying limestone and producing cement in Tmáň, located directly in the Czech Karst Protected Landscape Area (Seják et al. 1999). Another CVM study (WASTE) was also conducted in 1995, assessing the costs and benefits associated with the

[11] Benefit transfer is planned to be tested within several research project by Charles University Environment Center, particularly in the field of health valuation, in 2005.

introduction of a deposit-refund packaging system in the Czech Republic (Šauer and Mildeová 1998).

In 1996, CVM was also conducted in North Bohemia to measure households' WTP to reduce flood risks (FLOODS). All the households in the villages of Višňová and Minkovice evaluated several flood control projects and also expressed the real costs raised by actual flood waves in this area (Šauer et al. 1998). Valuation of recreational functions provided by forests in the Czech Republic in the period of 1994-1996 was carried out in three elicitation waves by Šišák et al. (1997) and the influence of air pollution-related stress was tested on the forest visitation (FOREST).

In 1998 Švejdarová and Mišovič (2004) applied the averting behavior method and tried to dislocate revealed preferences of households based on the purchasing of bottled water (WATER). She also compared her results with the values obtained by CVM application (Tošovská 1996).

Another type of research concentrated on landscape amenities was done in 2000 by Pražan (see Křůmalová, Pražan, Drlík (2000); Pražan (2004)) and in 2004 by Kubíčková (2004). CVM was applied in both cases. On the population of the Czech Republic, Pražan (LANDSCAPE) assessed the willingness to pay for further maintenance of Czech landscape by farmers. The second study presents a monetary valuation of the landscape amenity benefits of agriculture in the White Carpathians Protected Landscape Area (CARPAT).

In summer 2000, the travel cost method was applied by Melichar (2001) to estimate the effect of pine beetle damage and the consequent decrease in forest quality on recreational demand and benefits in a case study realized in the Šumava National Park (SUMAVA).

The further three studies were carried out to value the effect on human health. In 2002, Kutáček and Šeďa (2004) used conjoint analysis (CA) to obtain the value of a statistical life in road accidents (TRAFFIC). The other two studies were conducted by Charles University Environment Center in 2004 and 2005. The mortality study (Alberini et al. 2004) used a CV survey to elicit WTP for a reduction in the respondents' own risk of dying of cardiovascular and respiratory causes (MORTALITY). CUEC also conducted a research where morbidity impacts caused by air pollution are estimated (MORBIDITY). Preliminary results from a pilot survey and sensitivity analysis of external costs caused by transport are introduced in Ščasný, et al. (2005).

Scientific capacity building and research experience developed during the last years have led to the execution of other new non-market valuation studies in the Czech Republic. A CV survey on eliciting a monetary value for damage to children's health, particularly respiratory diseases, due to airborne pollution in two regions of Teplice (heavily polluted area) and Prachatice (less polluted area) is going to be carried out between May and June 2005 (CHILDREN); see a description of the research field in Braun Kohlová et al. (2004). This research follows up on an epidemiological research project by Šrám of the Institute of Experimental Medicine of the Czech Academy of Sciences (Šrám 2001). Another CV survey is planned to be carried out in autumn and winter 2005 in order to elicit willingness-to-pay for avoiding certain reduction in life expectancy and related quality of life in the last years of life (MORTALITY-LE). A combination of TC, CV and HP methods is planned to be carried out in the Jizerské Hory Protected Landscape Area in summer 2005 (JIZERKY). Travel costs related with area visit, willingness-to-pay to restore the character of the area and a fraction of

the second (weekend) house price thanks to the character of the Jizerské Hory mountains will be derived and sensitivity of various parameters to them will be tested.

Moreover, another two studies and surveys are going to be executed in the near future: a survey on valuation of occupational risks will be carried out in 2006-2007 under a 2005-2007 project funded by the Czech Ministry of Labor and Social Affairs ; a survey on valuation of environmental-related children's health impacts including a treatment of age and latency differences will be carried out in 2006-2007 under the VERHI project funded within the Sixth Framework Program of the European Commission. All of these studies are planned to be carried out in the Czech Republic by Charles University Environment Center in Prague. Information about all of the new valuation studies and activities, including students' theses is planned to be collected on the non-market valuation website [12].

Method Applied

As seen in Table 1, the most preferred valuation technique used was the contingent valuation method. The researchers used this technique in ten cases. The second-ranking technique based on stated preferences – the conjoint analysis – was applied in the CR once in 2002 (TRAFFIC). Revealed preference methods such as the travel cost method and the averting behavior method were not commonly used in non-market valuation studies, as we have found only one application of each of them (SUMAVA in 2000 and WATER in 1998). There has been no application of the hedonic pricing method in the Czech Republic so far. There are several real obstacles to implementing the HPM in the Czech Republic: the housing market is still relatively tightly regulated and can be characterized by relatively low mobility; the labor market is characterized by high unemployment and strong power of trade unions particularly in the sectors with relatively high occupational risks such as mining.

Willingness-to-pay was elicited in all the studies. None of the studies aimed at the elicitation of WTA to test a possible difference between WTP and WTA. The FUEL study represents a special case in that WTP can be derived as a difference between the real household expenditures related to switching fuels from coal to gas and the subsidy that would be required by them from public funds (a form of willingness-to-accept).

Research Area

The research area is briefly summarized in Table 1, more detailed information about the contingent product can be found in Table 4.

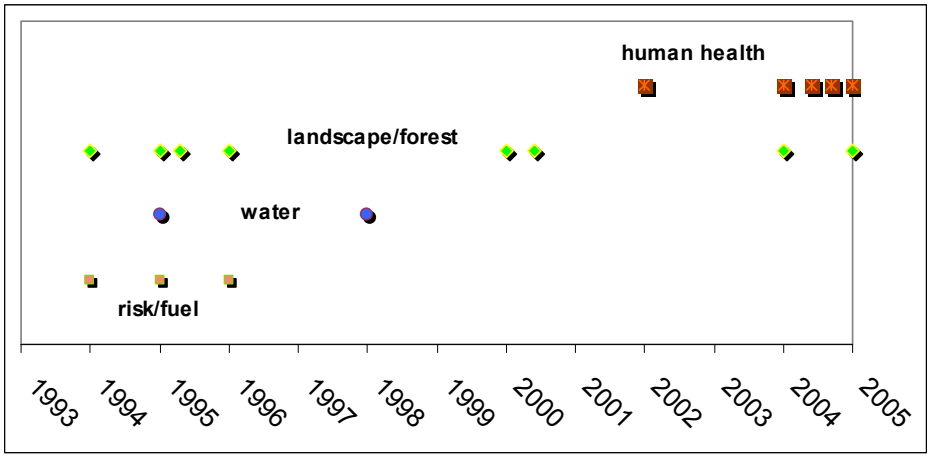
Among the 13 research studies carried out plus three ongoing in the Czech Republic, the most frequently studied research areas were the various **landscape amenities** and **functions provided by agriculture and forestry**. We identify six such studies (plus two more if we consider each of the three waves of FOREST a separate study). These studies were carried out during the entire examined period (see Figure 3). Two studies focused particularly on valuation of landscape amenities provided by agriculture (LANDSCAPE, CARPAT). Three studies deal with the recreational function of forestry (FOREST, SUMAVA, JIZERKY). The study LIMESTONE is a somewhat special case. Its area of study is defined by the various impacts potentially caused by building a limestone mine and a cement factory in a Protected

[12] The portal/platform on non-market valuation is recently installed and will be available at the web site of Charles University Environment Center (http://www.czp.cuni.cz; http://cuec.cuni.cz). Information can be obtained also from the authors of this paper.

Landscape Area. It focuses on the various landscape amenities, particularly the recreational function and restoration of biodiversity, the option value to store lime, the existence value of the protected area and the range of benefits related to the improved quality of air. These effects, however, can be received only mutually and the study refers to none of them explicitly as the primary one.

The second largest family of studies deal with **human health** valuation. In total, we can identify five such studies; three on mortality (TRAFFIC, MORTALITY, MORTALITY-LE), and two on morbidity (MORBIDITY, CHILDREN). This research area has been under exploration at the end of the investigated period, since 2002. It is also the area with the most dynamic progress.

Figure 3: Research area and the year of the valuation research in the Czech Republic.



Valuation of different **levels of risk** is analyzed in two of the studies; it is the risk associated with household waste (WASTE) and flood control projects (FLOOD). We can point out that mortality impacts in MORTALITY study are valued by eliciting WTP for own reduction of the risk of dying. Quality of **drinking water** was the subject of research in two cases; WATER uses ABM, AIR&WATER deals with water quality together with air pollution. FUEL deals with the product indirectly by investigating households' willingness to switch heating fuels. The research area can be identified as air pollution, or implicitly improved human health and visibility due to reduction in emissions at the site. All of these studies – carried out in the area of risks, water quality and fuel switching – were carried out at the beginning of the period, between 1994 and 1998.

Sociological Characteristics: Design, Sampling Strategy, Data Collection and Sample Size

In relation to research design, we can recognize the prevailing type of research as a descriptive quantitative research which was used in ten of the studies (this type will also be applied in CHILDREN and MORTALITY-LE). In three of the studies, the research was conducted as a quantitative case study (FUEL, FLOODS and SUMAVA). Quota sampling was applied to the entire Czech population in six studies (WASTE, FOREST, AIR&WATER, LIMESTONE, LANDSCAPE, WATER, and TRAFFIC). The entire Czech population was also represented by selected cities or regions in MORTALITY and MORBIDITY (also

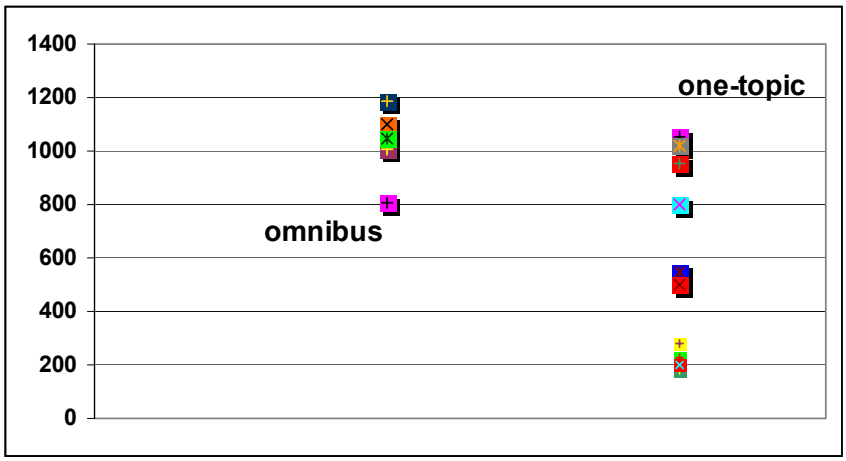
planned for MORTALITY-LE). Quota sampling was applied specifically to the people living in the affected region or city in three studies (FUEL, CARPAT; also planned for CHILDEN), SUMAVA and JIZERKY surveyed the selected visitors to the parks. FLOODS surveyed all the people living in the villages under investigation.

Where descriptive quantitative research was carried out, quota sampling was chosen as the sampling strategy. The other studies used purposive typologic sampling (FUEL), a census among the entire population living in the selected villages (FLOODS) and convenience cluster sampling (SUMAVA).

The prevailing mode of data collection was one-topic survey which occurred in eight studies (it holds also for all of the three planned studies). Omnibus, as the second type of data collection, was used in five cases.

The differences in sample size were quite large, varying from 180 (SUMAVA) to 1,461 (FOREST) respondents (see Figure 4). Small sizes of the samples are typical of the quantitative case studies, specifically, 180 respondents in SUMAVA, 226 in FLOODS, and 280 in FUEL (a sample of 200 respondents is planned for the MORTALITY-LE study; the data, however, will be cross-country analyzed among 6-7 European countries, and thus the entire sample will consist of around 1,200 respondents). The descriptive quantitative research conducted in ten studies was accompanied by quite large sample sizes. In four studies, the sample size was a little under one thousand respondents (the exception being the CARPAT study with 550 respondents; a sample size of 500 parents is planned for the CHILDREN study). The samples of two of the waves of FOREST in 1994 and 1995 also consisted of less than one thousand respondents (all three waves included 1,103 respondents on average). The sample sizes of the other six studies were over one thousand respondents. However, only two of them (WASTE and LANDSCAPE) did not collect data using omnibus.

Figure 4: Sample size and the mode of data collection.



Due to limited budget resources, the research in non-market valuation up to 2000 was carried out only using omnibus (except the three studies led by Šauer's team at the beginning of the 1990s – FUEL, WASTE, FLOODS). There is a powerful advantage to this type of data collection: it is relatively cheap (320 € to 380 € for one closed question, or 650 € for one open-ended question for a sample size of 1,000 respondents; 2004 prices). On the other hand,

the omnibus technique allows adding only a limited number of questions or text to the questionnaire. WTP/WTA can be also affected by the localization of the contingent part questions within the entire questionnaire. Thus, the contingent product and situation can be described only in a limited way. The reason for no-response or zero values cannot be identified and analyzed without appropriate questions being added to the questionnaire. For instance, 22% to 36% of the sample did not respond in the TRAFFIC survey, and we do not know what the reason was and how to interpret their preferences when mean/median WTP is estimated. Moreover, statistical or econometric analysis can be done only at a very limited, or basic, level.

Contingent Product and Information Bias

The contingent products offered to the respondent clearly vary among the analyzed studies and correspond to the respective research areas. The detailed specification of the products is also influenced by the mode of data collection. In one-topic survey studies, more information about the product is offered to respondents and, thus, the environmental goods are clearly understandable. One example could be the MORBIDITY study where contingent products such as 5 respiratory illnesses avoided in the next year were evaluated by the respondents. Willingness-to-pay questions on valuing the illnesses were asked separately and detailed information about length, severity and limitation to the job and ordinary activities were specified. The survey methods used in the MORTALITY, FUEL, FLOODS, WASTE, LANDSCAPE and CARPAT studies also provided the respondent with detailed information about the estimated goods in order to eliminate information bias. On the contrary, the specification of the contingent product was not sufficient in the AIR&WATER, FOREST and LIMESTONE surveys carried out using omnibus and that is why information bias could have occurred. The respondents were asked how much they were willing to pay for an additional forest visit for recreational purposes, and for drinking water and air quality improvement, in the FOREST and the AIR&WATER studies respectively. No other information at all was offered to the respondents to help them to derive their WTP values.

In the WATER and SUMAVA studies, the discussion of the contingent products is not relevant due to the method used. Both the studies tried to detect expenditures on water or travel costs. TRAFFIC let the respondents choose from two options with different petrol prices, maximum speeds and numbers of deaths due to car accidents.

Payment Vehicle

The payment vehicle is another factor which has a clear influence on the stated WTP (Bateman et al. 2002) and on protest bidding. There are several options for the respondent to make the potential payment for the contingent product in the questionnaire (see above).

The preferred mode of payment vehicle was increased expenditures of an individual or household for buying the contingent product, which occurred in five of the studies (MORBIDITY, MORTALITY, SUMAVA, WATER and FOREST). A contribution to the conversion costs of fuel perceived by a household in the FUEL study can also be considered one form of this type of payment vehicle (reduced expenses and/or savings). A reduction in the monthly income of a family or respondent is introduced in FLOODS. WASTE uses a mix of the expenses/savings reduction and tax increase as types of payment vehicle.

In two cases, the payment vehicle was represented by an increase in prices (TRAFFIC and LIMESTONE) and contributions to special funds (CARPAT and AIR&WATER). An increase in the respondent's annual tax payment was used in the LANDSCAPE study.

So far, the impacts of different payment vehicles on the magnitude of stated WTP have not been tested in Czech studies. It could be one suggestion for very interesting scientific investigation, particularly if carried out in one of the former transition countries.

Elicitation Question Formats and Protest Bids

Another interesting statistics can be made comparing the elicitation question formats of the studies. The prevailing format of the willingness-to-pay question in the Czech studies is an open-ended question, which we have found in 8 surveys and, obviously, in the ABM study (WATER). The open-ended questions in the FUEL, WASTE and FLOODS surveys (all done by Šauer's teams) provided an initial bid offered by the respondent, which then was followed by a bidding game. The LANDSCAPE survey operated with open-ended questions with one follow-up. In the CARPAT study the willingness to pay was tested on two sub-samples of respondents, one with the open-ended format, the other with a dichotomous choice.

The dichotomous choice format was used in two studies. The double-bounded dichotomous choice format in the MORTALITY study was accompanied by one open-ended question. The TRAFFIC study applied single-bounded dichotomous choice (referendum method). A ladder approach using payment cards was used in MORBIDITY (also in CHILDREN), in the LIMESTONE study the payment card approach was followed up by one open-ended question.

Very important issues here are analysis of protest bids, treatment of "no response" and distinction between real "zero" values and those zeros that are in reality "protest bids". If the respondent "protests" because he/she does not like the product, considers it strongly immoral or unethical to attach a monetary value to the analyzed good, is not used to making such choices, rejects the contingent situation or even the whole questionnaire and research, then the interviewer and researcher should leave such a respondent out of the sample. Only if the respondent does not protest for any of the above mentioned reasons, still stating a zero value, for example because he/she cannot afford the payment, should the respondent's WTP be considered equal to real zero. Mean or median WTP can be estimated firstly by using only positive WTP/WTA without protest bids and real zeros; then, WTP/WTA can be estimated for a dataset including also the real zero values; lastly for comparison, for the dataset including positive WTP/WTA, real zero values and protest bids that are also considered zeros. Ideally, mean/median WTP/WTA should be estimated using the second method (for positive and real zero values).

Proper treatment of protest bids and real zeros was not, however, always the case in the Czech studies. To our knowledge, protest bids were only analyzed in LANDSCAPE, CARPAT, MORTALITY and MORBIDITY by batteries of appropriate questions. Special attention should be paid to the results of the AIR&WATER and FOREST studies, where a high rate of zero bids was present. In the AIR&WATER study almost 57% of respondents declared zero WTP, in the case of FOREST, the number was even higher (67%; in the 1994 wave, only 13% were willing to pay some additional money for a forest visit, 19% were undecided whether to pay any money). Thus, the real preferences of this difficult sample of respondents could not be derived because no motivation for declaring zero WTP in the questionnaire was identified. Information bias could be the reason for the high zero values in the sample. It is likely that the contingent product was insufficiently specified or was not credible to the

respondents. The format of selected payment vehicle can also have biased the stated values and, thus, the free-riding problem can have occurred. This is one very serious limit to omnibus surveys, which do not allow us to ask more questions and give specific information in the questionnaire.

Results and Statistical Analysis

Table 4 presents the final results of the non-market valuation studies carried out in the Czech Republic, along with our remarks. In most cases the WTP is expressed as a mean value. Median values are rarely introduced in these studies (e.g. in FUEL, WASTE, FLOODS, MORTALITY, MORBIDITY, CARPAT).

Value is commonly expressed in various ways; WTP per month is presented in four studies (LIMESTONE, WASTE, AIR&WATER and WATER), WTP per year is stated in three studies (LANDSCAPE, CARPAT and MORTALITY). Monetary value is stated as WTP per unit of product, such as per visit, in two studies (SUMAVA and FOREST) and as yearly payment for a certain health symptom in MORBIDITY (also in CHILDREN). In two studies, values were also expressed as WTP for particular suggested measures, e.g. flood risk reduction projects (FLOODS, FUEL). The TRAFFIC study derives the value of a statistical life (VSL) using differences in petrol prices and numbers of deaths due to car accidents for two competing options, while keeping petrol consumption constant. VSL in MORTALITY is recalculated for a full risk reduction of dying (or certain life) from stated WTP for a certain risk reduction of dying.

In several studies the environmental attitudes of respondents were observed, namely in WASTE, FLOODS, LIMESTONE and LANDSCAPE. Unfortunately, the influence of the environmental attitudes on WTP was not tested. The MORBIDIDY study is a different situation as it tests the impact of various attitudes on respondents' WTP, including environmental context (on one half of the sample). On the contrary, the MORTALITY study is an example where environmental context was not mentioned in the questionnaire with a direct intention.

Looking at the intensity of statistical and econometrical analysis, more sophisticated work was done in the MORTALITY and CARPAT studies (data analysis will be made in MORBIDITY and in the new studies CHILDREN, MORTALITY-LE and JIZERKY). Only basic descriptive statistics were made in all of the remaining studies, that is FUEL, WASTE, FLOODS, AIR&WATER, FOREST, LANDSCAPE, TRAFFIC and WATER.

Policy Demand

Another important point is how the results are used in policy and decision making. The source of funding for the studies could be a helpful indicator. Of all the 16 finished and ongoing non-market valuation studies, most were funded by the central state administration: three by the Ministry of the Environment (WASTE, MORBIDITY, CHILDREN), one by the Ministry of Agriculture (LANDSCAPE) and one by the Ministry of Transport (TRAFFIC), and two studies by the Institute for Public Opinion Research of Czech Statistical Office[13]. Five studies were fully or partially funded by the Czech Science Foundation (FOREST, AIR&WATER,

[13] IVVM - Public Opinion Research Institute of Czech Statistical Office was transformed into CVVM – Public Opinion Research Centre in January 2001 that is based at Sociological Institute of Czech Academy of Sciences.

LIMESTONE, CARPAT, MORTALITY). Foreign institutions funded or co-funded five studies (FUEL, FLOODS, WATER, MORTALITY, MORTALITY-LE). SUMAVA was funded by the authors' own resources, JIZERKY is co-funded by an internal grant of the University of Economics in Prague and the Ministry of the Environment.

So far, only two studies have been funded from the programs of the European Commission (MORTALITY-LE and MORTALITY, which was funded via a subcontract of the World Health Organization). Still, the scientific circles show little wider participation in research programs funded by the European Commission. Therefore, more benefits – in terms of knowledge as well as financial resources – can bring wider participation of scientists and researchers in these programs.

Although the results provided by non-market valuation studies can be easily used in policy and decision-making, the attitudes of state authorities towards using these results is still stand-offish and cautious. Moreover, the results have been unknown to politicians hiding in desk-shelves. Certain progress can be seen in the state administration over the last years, when the results of the non-market valuation have been noticed. The authorities' perception of and attitudes towards the need for non-market values has also changed – even explicitly in several government policies and strategies. The need for valuing the environment and natural resources arises directly from the National Program on Preserving Nature and Landscape of the Czech Republic (Ministry of the Environment 1998) and the Government Decision no. 207 dated February 27, 2002 (Government Decision 2002). Both the documents declare the need for valuing the environment, including its non-productive functions. These documents also call for building up a methodological approach for valuing natural assets. Despite the recent developments and changes in the state authorities' attitudes, the Czech ministries still prefer requesting and using experts' values in order to support their decisions and the real stated or revealed preferences perceived by the affected population have remained ignored.

5. Environmental Valuation Studies in Hungary and Poland

We are grateful to our Polish and Hungarians colleagues, Anna Malgorzata Bartczak from the Department of Economic Sciences at Warsaw University (WUDES 2004) and Noémi Nagypál from the Department of Environmental Economics at Budapest University of Technology and Economics (Nagypál 2005), who provided us with overviews on the progress of non-market valuation in their countries. We summarize our description of all Hungarian and Polish studies in tables attached in the Appendix 2 (see for Hungarian studies Table 6 and 7; for Polish studies Table 8-11).

Hungarian Non-Market Valuation Studies

Situation identical to that of the Czech Republic can be observed in Hungary. Since the beginning of the 1990s, several non-market valuation studies have been developed to measure values of environmental goods or environmental changes. In Hungary 11 environmental studies have been carried out so far, the contingent valuation method being the preferred technique. CVM was used in 9 cases, the cost-based method and benefit transfer were applied in three cases (DANUBE, WATER REGULATION and WATER DIRECTIVE), the travel cost method twice (BALATON and NATIONAL PARK) and the hedonic pricing method in one study (HAZARDOUS WASTE).

Studies such as NATIONAL PARK, CAVE, DANUBE and FOREST aimed at valuation of benefits coming from the conservation of the Bükk National Park, the Pál-völgyi and Szemlő-hegyi caves, the Szigetköz and the Danube bend, and the Gemenc floodplain forest by the River Danube, respectively. Assessment of water quality improvements was another research area. The first water quality study, BALATON, focused on valuation of benefits of water quality improvement of Lake Balaton. The second one, WATER REGULATION, was aimed at measuring environmental changes in water regulation according to the so-called New Vasárhelyi plan, and the third one, WATER DIRECTIVE, measures environmental changes in water regulation according to the EU Water Directive. The fourth water study, TISZA, tried to assess the benefits associated with pollution risk reduction of the River Tisza. Two other valuation studies were specialized on waste management improvements. The WASTE DUMP study estimated willingness to pay among citizens to modernize the Röszke waste dump, HAZARDOUS WASTE assessed benefits from re-cultivation of the Debrecen Szikgát hazardous waste dump. The last reviewed study, AIR, estimated benefits of air quality improvements.

Since we have obtained incomplete information about Hungarian studies, a precise analysis of all the characteristics is impossible and needs completing. But what we have now is some information about research designs and sample sizes. The research designs of most of the studies were developed as local surveys and thus relatively small samples were collected. The sample sizes are known for the CAVE study (300 respondents) and the FOREST study with 400 respondents. On the other hand, studies such as AIR, BALATON and DANUBE were designed as national surveys and what we know is that the BALATON study was based on a large sample. As for the previous studies, the precise number of the sample size is unknown to us at the moment.

The other incomplete information relates to the payment vehicles and question formats used in two studies. In the BALATON study, a tax was used as the payment vehicle and the open-ended question format combined with dichotomous choice. The payment vehicle of the CAVE study was designed as single payment into a cave protection fund; the open-ended question format was used for 150 respondents, while the other 250 were presented with dichotomous choice. The question format of the FOREST study was constructed as open-ended.

Polish Environmental Valuation Studies

The situation in Poland is similar to that in the previously analyzed countries. Until now, 12 non-market valuation studies have been conducted in Poland. The method most widely used (eight times) was the contingent valuation method. The travel cost method was applied in three cases, and the hedonic pricing method was conducted once.

Research activities were mainly aimed at valuating benefits related to water quality improvements. The studies SEA WATER I, II and III dealt with valuing of losses due to eutrophication of the Baltic Sea and losses associated with forced beach closures. Two other water studies, DRINKING WATER I and II, aimed at valuation of high quality water taken from Oligocene wells available free-of-charge in wells opened for public by the municipal authorities. The SURFACE WATER I and II studies were concerned with benefits associated with surface water improvements, such as the implementation of the new directive 91/271/EC concerning municipal wastewater treatment. There are two studies other, HOUSE and AIR QUALITY, concerned with the effects of air pollution. In the first one, a series of hedonic pricing models were built in order to determine the effect of prices on such environmental

amenities as green neighborhood, clean air or low noise. The second study estimated WTP to avoid damage related to air pollution. The possible damage due to air pollution was divided into eight components: mortality, bronchitis, asthma, minor health symptoms, loss of visibility, material damage, damage to historical buildings and monuments, and ecosystem damage. The last three studies were aimed at valuing of forest amenities. In the WETLAND study, the improved level of protection of the Biebrza Wetlands was estimated. The aim of the LANDSCAPE study was an estimation of costs and benefits (such as change in landscape, local climate and losses in flora and fauna) associated with the construction of a dam in the Pieniny National Park. And finally, the FOREST study estimated tourist value associated with forest amenities and biodiversity in the Bialowieza Primeval Forest.

When we look at the survey characteristics of the Polish studies, we can summarize that seven studies (SEA WATER I, II, III, WETLAND, AIR QUALITY, SURFACE WATER I and II) can be considered representative as the results of these studies come from nation-wide samples. The typical size of the sample was over one thousands respondents, only in the SEA WATER III study, which used a mail survey, the sample size was 304 respondents. Except the mail survey realized in SEA WATER III, face-to-face interviews were conducted in the other mentioned studies. The surveys in the other five studies (DRINKING WATER I, II, HOUSES, LANDSCAPE and FOREST) were designed as local-specific. In the case of the DRINKING WATER studies, Warsaw citizens who came to 15 water wells to get water were interviewed. The LANDSCAPE and FOREST studies only dealt with visitors to the Pieniny and Bialowieza Primeval Forest National Parks respectively, using face-to-face interviews. In the case of the HOUSE study, the Warsaw real estate market was used for the construction of the hedonic price models. The sample size of these studies was also quite large, around one thousand respondents.

The other examined characteristics of the studies were the type of payment vehicle and the elicitation question format. An annual tax as the payment vehicle occurred in five studies (SEA WATER I, II, III, WETLAND and AIR QUALITY), a fee was used in three studies (DRINKING WATER I, SURFACE WATER I and II), travel expenses in two cases (DRINKING WATER II, FOREST), and one study used a price offer (HOUSE).

In studies such as SEA WATER II, III, WETLAND and DRINKING WATER I, dichotomous choice questions with 8 random bids were used, while open-ended questions were used in three studies (SEA WATER I, SURFACE WATER I and II) and both formats were applied in one study (AIR QUALITY).

6. Conclusion

In spite of a lack of past experience, of the dramatic changes in the Czech, Hungarian and Polish societies and economies, of the very limited financial support from public sources and of high costs related to non-market valuation studies and surveys, the enthusiasm of scientists and researchers has led to the execution of a larger than negligible amount of non-market valuation studies in the environmental field since the beginning of the 1990s.

In total, we have identified 39 such studies carried out in the Czech Republic, Hungary and Poland. The most examined research area was landscape amenities provided by agriculture and forestry in the Czech Republic (6 studies out of 16), whereas it was water-related benefit/damage in Poland (7/12) and Hungary (5/11). Nature conservation also presents an often considered area in Hungary (4/11). Valuation of human health does present a relatively

new area with the most dynamic progress in the Czech Republic (5/16); see Figure 6 in Appendix 3. The first non-market valuation study in all the three countries was carried out in 1994. Three-quarters of all the studies have applied CVM, either exclusively or in combination with another method (30/39). We identified only six TCM, three BT and HPM applications, and one application of the ABM and CA methods; see Figure 7 in Appendix 3.

If we look at the Czech Republic, in addition to the 13 non-market valuation studies that have been done, there are three more on-going and two new research activities. Most of them are dealing with damage to human health. No doubt there may be more non-market valuation research activities and applications such as students' theses and pilot studies that we have not discovered yet and thus included in our database and review.

There has been more rapid and vivid progress in non-market valuation activities in the Czech Republic since 2004. Besides the new studies, it is worth mentioning some further activities and outcomes. First of them is the international seminar on **"Lessons in non-market valuation methods in the environmental field"** that was organized in Prague in October 2004 with this book of proceedings being its result. The seminar aimed at scientific capacity building and discussion of the latest experience and results in the Czech Republic. Moreover, a **Platform on non-market valuation**[14] experienced in the CEEC is planned to be established in order to develop a network for further information and experience exchange between interested researchers, academics, students, NGOs and state administration. Last but not least, a **"Summer School of Valuation of the Environment"** focusing primarily on non-market valuation methods will be jointly organized by Charles University Environment Center and the University of Economics in Prague. It will be held in July 2005 in the Jizerské Hory Protected Landscape Area, located in the north of the Czech Republic.

We are convinced that in spite of the tardy development and certain suspicion or even hesitancy to non-market valuation methods at the beginning of 1990s, several research teams interested in developing and applying the method have been put together and endowed with good experience, professional skills and training. Particularly, we can mention the collaboration between the Department of Environmental Economics at Budapest University of Technology and Economics, the Department of Economic Sciences at Warsaw University, the Department of Environmental Economics at the University of Economics in Prague and Charles University Environment Center.

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[14] Platform/network on non-market valuation methods and more information about Summer School on non-market valuation can be found at http://cozp.cuni.cz (link through menu or environmental economics) or can be required directly from the authors.

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Appendix 1: SEEA-2003 classification

There are two large families of methods for assessing environmental degradation in the SEEA-2003 classification (UN et al. 2003): cost-based methods and damage- or benefit-based methods.

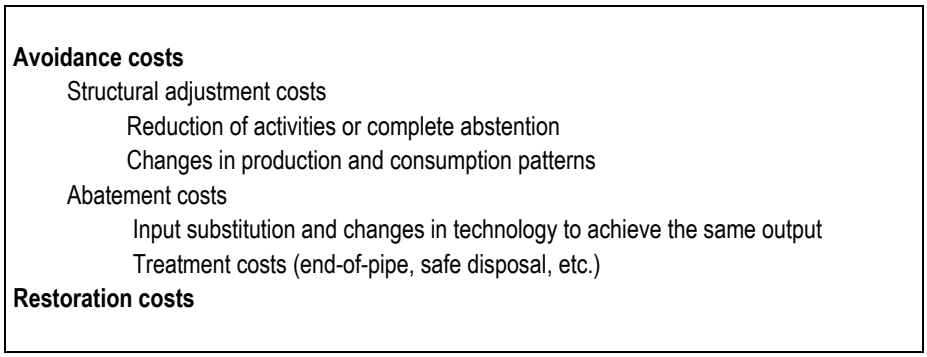
Cost-based methods

The subject matter of the method is the costs involved by an activity that avoids the damage or costs involved by another activity which restores damage that has already been caused, for instance by pollution. Cost-based methods do not usually estimate the damage or benefit itself, rather, they provide a proxy value of the damage or benefit and can be used, in principle, in cost-effectiveness analysis.

In principle, there are three ways in which pollution can be reduced and the costs can be identified and then valued (see Figure 5). Firstly, measures can be applied to avoid production of the emission in the first place, either by refraining from the activity giving rise to the emission or by substituting less damaging inputs and outputs or even the production technique. Reducing the activities or changing the patterns generates structural adjustment costs. The second solution is to capture the emissions and make them less harmful, for example by installing scrubbers on processing equipment (leading to abatement costs). Structural adjustment costs – involved by refraining from the activity or by changing patterns - can then be estimated mostly by modeling. Contrary to the abatement, the structural adjustment measures need not sustain the output level constant. While structural adjustment costs are allocated in order to avoid the damage or certain environmental change by changing the structure, abatement costs are generated by changing the process while sustaining the output constant.

The third option is to restore the environment by means of clean-up activities such as rehabilitation of agricultural land or restoration of contaminated water bodies. Restoration costs can also include the mitigation/abatement of accumulated damage required to return to this standard. Restoration costs are expended after the environment has been changed in order to restore the site or quality as it had been before.

Figure 5: Classification of Cost-based Methods of Environmental Degradation Valuation.



Damage/benefit-based methods

Damage or benefits can concern marketed or non-marketed goods and services.

If damage/benefit concerns a marketed goods or service, a relevant effect or impact caused by a certain (environmental) change is observed, and then the effect/impact is valued. The effect can be valued directly using market prices. SEEA-2003 identifies the following cases:

- if the effect leads to a decrease in the lifetime of a fixed asset or its productivity (e.g. a rented house), the price of the fixed asset falls, which can be attributed to environmental damage. The damage is, in this case, valued directly by the change in the asset value. Damage can be also valued by higher maintenance costs (e.g. treatment of soiling and corrosion effects on buildings and materials due to air pollution). If the price change is not directly obvious, the hedonic pricing method should be used;
- if the effect leads to a decrease in output (e.g. of crops or roundwood caused by airborne pollution), the damage can be valued by market prices of the lost crop or wood;
- if the effect induces averting behavior and, therefore, expenditures to prevent or avoid a negative welfare effect, these expenditures can be used to estimate the monetary value of the damage (e.g. purchase of water purifiers or noise insulation).

If the damage/benefit concerns non-market goods or services, then non-market valuation methods should be applied. These methods are presented in detail in Chapter 3.2.

Appendix 2: Review of the non-market valuation studies and their characteristics carried out in the Czech Republic (Table 1-5), Hungary (Table 6-7) and Poland (Table 8-11).

Table 1: Overview of the Non-market Valuation Studies in the Czech Republic.

Authors	Acronym	Method	Date of research	Research area
Šauer P., Dvořák A., Paroha L., Carmin J., Andrews R.	FUEL	CVM	April-May 1994	Household heating
Šišák L., Pulkráb K., Kalivoda V.	FOREST	CVM	1. 1994; 2. 1995; 3. 1996 (September)	Forest
Šauer P., Mildeová S.	WASTE	CVM	November 1995	Household waste
Tošovská E.	AIR&WATER	CVM	April 1995	Air and water quality
Seják J. et al.	LIMESTONE	CVM	June-July 1995	Limestone mining
Šauer P., Dvořák A., Mildeová S., Mokrišová J.	FLOODS	CVM	July 1996	Flood control measures
Švejdarová H., Mišovič J.	WATER	ABM	November 1998	Water quality
Křůmalová V., Pražan J., Drlík J.	LANDSCAPE	CVM	2000	Agriculture
Melichar J.	SUMAVA	TCM	July - October 2000 –	Recreation
Šeďa V., Kutáček S.	TRAFFIC	CA	November 2002	Human health (mortality)
Kubíčková S.	CARPAT	CVM	March-May 2004	Agriculture
Alberini A., Ščasný M., Braun Kohlová M., Melichar J.,	MORTALITY	CVM	April–September 2004	Human health (mortality)
Melichar J., Ščasný M., Havránek, M., Braun Kohlová M., Máca, M., Urban J.	MORBIDITY	CVM	November 2004 – February 2005	Human health (morbidity)
CUEC (Braun Kohlová M., Melichar, J. Máca, V., Ščasný, M., Urban J.)	CHILDREN	CVM	April-June 2005	Human health (infant morbidity)

Table 2: Short Description of the Non-market Valuation Studies in the Czech Republic.

Acronym	Document description
FUEL	This study examines levels of subsidies desired by households to convert heating fuel from coal to natural gas in the industrial city of Děčín. CVM was applied to obtain household preferences concerning the fuel conversion.
FOREST	The paper describes research on valuation of recreational function of forest in the Czech Republic in the period 1994-1996. The influence of air pollution-related stress was tested on the forest visitation and the amount of collected non-wood forest produce between different regions in the Czech Republic.
WASTE	The costs and benefits associated with introducing a deposit-refund packaging system were calculated using the CV method in the Czech Republic. The study considered three different kinds of household waste and the values that individuals associate with reducing the risks of dumping were determined.
AIR&WATER	In this paper the WTP of households for drinking water and air quality improvement is determined using CVM. These data are aggregated and thus, the annual WTP of the Czech household is amounted to CZK 2 billion.
LIMESTONE	This study presents the attitudes of the Czech households towards the construction of a cement factory in the Czech Karst Protected Landscape Area. The economic value of the site was estimated using a CVM survey and the efficiency of the investment was discussed.
FLOODS	The CVM was conducted in the villages of Višňová and Minkovice to collect the data about households' WTP to reduce flood risks in the case when several flood control projects would be implemented. Further, a cost-benefit analysis was conducted to determine the effectiveness of the suggested flood projects.
WATER	This paper describes an application of the averting behavior method based on bottled water purchasing to dislocate revealed preferences. The results are compared with the application of the contingent valuation method.
LANDSCAPE	CVM was applied to assess the willingness to pay for further maintenance of Czech landscape by farmers and thus, whether state support to farmers is legitimate. Citizens' attitudes toward the role of farmers in maintenance of landscape amenities were also collected.
SUMAVA	The travel cost method was applied to the issue of estimating the effect of tree density on recreational demand and benefits in a case study of pine beetle damage to forest quality in National Park Šumava.
TRAFFIC	This paper presents the research conducted by the Transport Research Center to derive the value of a statistical life in road accident in the Czech Republic.
CARPAT	This paper presents a monetary valuation of the landscape amenity benefits of agriculture in the White Carpathians Protected Landscape Area. CVM was applied to assess the benefits associated with agricultural activities contributing to landscape preservation.
MORTALITY	The paper presents research design and results of a CV survey to elicit WTP for a reduction of respondents' own risk of dying of cardiovascular and respiratory causes.
MORBIDITY	The study describes the results of a pre-survey and a pilot survey of a final questionnaire. Ščasný et al. (2005) introduces the preliminary results from the pilot survey phase of the research and a sensitivity analysis linked to the magnitude of external costs of transport. Final results of the research will be provided by summer 2005.
CHILDREN	The report describes the method and assumption of the survey. The CV survey will be carried out in April to June 2005 in order to establish WTP of mothers (parents) for avoiding four symptoms of respiratory diseases in their children and WTP for avoiding own respiratory diseases in the regions of Teplice (heavily polluted area) and Prachatice (less polluted area).

Table 3: Research and Sampling Characteristics in the Czech Non-market Valuation Studies.

Acronym	Research design	Sampling	Data collection	Sample size
FUEL	Quantitative case study in the city of Děčín	Purposive typologic sampling	One-topic survey	n = 280 households; Response rate 86 %
FOREST	Descriptive quantitative research	Quota sample	Omnibus	n = 856 in 1994; n = 991 in 1995; n = 1,461 in 1996
WASTE	Descriptive quantitative research	Quota sample	One-topic survey	n = 1,056 respondents
AIR&WATER	Descriptive quantitative research	Quota sample	Omnibus	n = 804; Age of respondents over 27 years
LIMESTONE	Descriptive quantitative research	Quota sample	Omnibus	n = 1,008
FLOODS	Quantitative case study in the villages of Višňová and Minkovice	Census of the whole population living in the villages	One-topic survey	n = 226 households; Response rate 97 %
WATER	Descriptive quantitative research	Quota sample	Omnibus	n = 1,189
LANDSCAPE	Descriptive quantitative research	Quota sample	One-topic survey	n = 1,018
SUMAVA	Quantitative case study in the Šumava National Park	Convenience cluster sample	One-topic survey	n = 180
TRAFFIC	Descriptive quantitative research	Quota sample	Omnibus	n = 1,045
CARPAT	Descriptive quantitative research of general public	Quota sample	One-topic survey	n = 550
MORTALITY	Questionnaire survey in the cities of Praha, Brno and Ostrava	Quota sample	One-topic survey	n = 954
MORBIDITY	Questionnaire survey in 5 Czech regions	Quota sample	One-topic survey	n = 760
CHILDREN	Questionnaire survey in two regions (Teplice, Prachatice)	Random sample from long-term examined families	One-topic survey	n = 500

Table 4: Description of the Contingent Product, Payment Vehicle and Question Format in the Czech Non-market Valuation Studies.

Acronym	Description of the contingent product	Payment vehicle	Elicitation question format
FUEL	The household's replacement of brown coal with natural gas	Contribution to conversion costs perceived by households	1. Open-ended (initial bid offered by respondent); 2. Bidding game
FOREST	Additional forest visit for recreational reasons	Increase in expenditures spent on forest visits	Open-ended
WASTE	1. Reduction of 3 types of risks related to dangerous household waste; 2. Reduction of risk from unofficial dumps; 3. Battery disposal	1. Reduction in the individual's monthly income ; 2. Reduction in price	1. Open-ended (initial bid offered by respondent); 2. Bidding game
AIR & WATER	Drinking water and air quality improvement	Contribution to a local budget	Open-ended
LIMESTONE	Modernization of an existing cement factory and thus retaining the current state of the Protected Landscape Area	Increase in price of cement and thus increase in prices of different goods and services	Payment card
FLOODS	Reduction of flood risks due to implementation of 6 flood control measures	Reduction in the family's monthly income	1. Open-ended (initial bid offered by respondent); 2. Bidding game
WATER	Bottled drinking water	Real expenditures	-
LANDSCAPE	Improvement of quality of landscape amenities	Increase in the respondent's annual tax payment	Open-ended with 1 follow-up
SUMAVA	Recreation visits to the Šumava National Park	Travel costs	Open-ended
TRAFFIC	Avoided fatalities by car accidents	Increase in petrol price	Dichotomous choice in pair comparison
CARPAT	Maintenance of agricultural activities contributing to landscape preservation to ensure the conservation of the currently cultivated landscape	Contribution to a special fund of the Protected Landscape Area	1. Open-ended; 2. dichotomous choice
MORTALITY	Reduction of own actual and future risk of dying of cardiovascular and respiratory diseases (medical treatment or abstract option)	Direct periodical payment every year over next 10 years	Dichotomous choice with 1 follow-up and 1 open-ended question
MORBIDITY	5 respiratory illnesses avoided in the next year (asked separately)	Direct single payment for a one-year period	Payment scale with an open end
CHILDREN	respiratory illnesses avoided during one year (4 for children, one for parent)	Direct single payment for a one-year period	Payment scale with an open end

Table 5: Study Results and Remarks of the Czech Non-market Valuation Studies.

Acronym	Results	Remarks
FUEL	1. Households which had already changed the fuel: average costs: CZK 41,000, average desired subsidy: CZK 13,530; 2. Households which had not changed the fuel: average costs: CZK 56,000, average desired subsidy: CZK 32,890, median: CZK 30,000	
FOREST	WTP 1. CZK 3.08 per visit; 2. CZK 7.72 per visit; 3. CZK 32.24 per visit (mean); WTP 0 CZK 67% of the sample	No identified motivation for declaring zero WTP
WASTE	1. WTP for high level of risk: CZK 21 per month; medium level: CZK 13.20 per month; the lowest level: CZK 12.90 per month (average); median values are lower; 2. WTP with unofficial dumps risk: high level risk CZK 24.20 per month; medium level CZK 15.80 per month; the least level CZK 15.20 per month (average); 3. WTP for battery disposal: CZK 4 per battery; WTA: CZK 2.20 per battery	Environmental context such as dangerous household waste causing a series of health risks
AIR & WATER	1. WTP for air: 38% of sample will pay max. CZK 100 per month, 57% no WTP; 2. WTP for water: 39% of sample will pay max. CZK 100 per month, 56% no WTP	
LIMESTONE	WTP CZK 50 per household per month	Environmental attitudes
FLOODS	1. Višňová WTP: CZK 169 (average), CZK 100 (median); 2. Minkovice WTP: CZK 85 (average), CZK 50 (median)	Environmental attitudes
WATER	WTP CZK 75 per household per month	
LANDSCAPE	WTP CZK 620 per person and year (mean); 492 CZK per person if zero values are considered. 31% respondents WTP CZK 1,200 (DC format) in order to provide harmonic landscape.	
SUMAVA	WTP CZK 3,317 per individual visit	
TRAFFIC	Value of a statistical life CZK 14-32 mil.	
CARPAT	1. opened ended: WTP CZK 295-340 CZK per person per year (mean), CZK 200 p/y (median); 2. dichotomous choice: WTP CZK 664 p/y (mean), CZK 338.23 p/y (median)	
MORTALITY	Mean VSL 40.16 mill. CZK (€1.27 million at the current exchange rate, €2.86 million at the PPP), median VSL 18.52 million CZK (€0.58 million, or €1.32 million at the PPP). The VSL is lower for older people, but not for individuals with cardiovascular or respiratory illnesses.	No environmental context mentioned. Econometrical analysis done (Weibull distribution applied). Scope test will be tested.
MORBIDITY	Cough (mean CZK 278/9.3€, median 50/1.7€), Eye irritation (CZK 295/9.8€, CZK 20/0.7€), Stay in bed (CZK 574/19.1€, CZK 150/5.0€), Casualty – emergency room visit (CZK 794/26.5€, CZK 200/6.7€), Hospital admission (CZK 1,477/49.2€, CZK 500/16.7€)	Impact of attitudes on respondents' WTP tested. Environmental context included and tested.
CHILDREN	Not yet available	No environmental context is mentioned. The survey follows up TEPLICE Program and mothers investigate there.

Table 6: Environmental Valuation Studies in Hungary.

Authors	Acronym	Research area	Method	Year of research	Research design	Sample size
Powell et al.	AIR	Air quality	CVM	1994	Hungary	
Mourato et al.	BALATON	Water quality	CVM, TCM	1995, 1996	Settlements by Lake Balaton and in Hungary (on and off-site test)	First large sample survey
Szerényi	NATIONAL PARK	Nature conservation	CVM, TCM	1996	Visitors to Bükk National Park	Relatively small sample
Kaderják et al.	WASTE DUMP	Waste management	CVM	1997	Röszke	Local survey
Kaderják, Szekeres	HAZARDOUS WASTE	Waste management	CVM?, HPM	1998	Debrecen city	
Szerényi	CAVE	Nature conservation, caves	CVM	2000	Budapest city and surrounding settlements	400
Fucskó et al.	DANUBE	Nature conservation	CVM, Cost-based methods, Benefit transfer	2001	Hungary	National survey
Nagypál	FOREST	Nature conservation	CVM	2002	Settlements near Gemenc (Szekszárd, Tolna, Decs, Sárpilis, Pörböly)	300
Szerényi	TISZA	Water pollution	CVM	2002	Settlements by the River Tisza	
Szerényi	WATER REGULATION	Water quality	Cost based methods, Benefit transfer	August-September 2003	-	-
Szerényi	WATER DIRECTIVE	Water quality	Cost based methods, Benefit transfer	November 2003 - February 2004	-	-

Based on data from Nagypál (2005).

Table 7: Environmental Valuation Studies in Hungary, cont.

Acronym	Hypothetical product	Payment vehicle	Question format	Results	Environmental context	Remarks
AIR	Benefits of air quality improvement					First CVM survey in Hungary
BALATON	Benefits of water quality improvement in Lake Balaton	Tax	1. open-ended; 2. dichotomous choice	Annual WTP of US$ 27	Environmental attitude	Joint research with CSERGE
NATIONAL PARK	Conservation of Bükk National Park				Environmental attitude	Simple questionnaire together with simple TCM questions
WASTE DUMP	WTP among citizens to modernize Röszke waste dump					
HAZARDOUS WASTE	Benefits from re-cultivation of Debrecen Szikgát hazardous waste dump					As part of CBA for setting priority order for Environmental Remediation Program
CAVE	Value of Pál-völgyi & Szemlő-hegyi caves	Single payment into a cave protection fund	1. open-ended (n = 150); 2. dichotomous choice (n = 250)	1. WTP 1,214 HUF 2. WTP 1,356 HUF	Environmental attitude	First survey with high-level methodology among nature conservation related goods
DANUBE	Benefits from the conservation of natural capital of Szigetköz and Danube bend				Environmental attitude	Research related to Slovak - Hungarian Gabčíkovo - Nagymaros power plant construction
FOREST	Value of conservation of Gemenc floodplain forest by the River Danube	Not defined	open-ended	Avegare WTP 3,183 HUF	Environmental attitude	Final thesis, small sample, simple questionnaire
TISZA	Social support to reduce pollution risk of the River Tisza					
WATER REGULATION	Natural capital changes in water regulation according to the so-called New Vasárhelyi plan					
WATER DIRECTIVE	Natural capital changes in water regulation according to the EU Water Directive					

Based on data from Nagypál (2005).

Table 8: Overview of the Non-market Valuation Studies in Poland.

Authors	Acronym	Method	Date of research	Research area
Markowska A., Żylicz T.	SEA WATER I	CVM	1994	Baltic Sea eutrophication and quality of beaches
Markowska A., Żylicz T.	SEA WATER II	CVM	1994	Baltic Sea eutrophication and quality of beaches
Markowska A., Żylicz T.	SEA WATER III	CVM	1995	Baltic Sea eutrophication and quality of beaches
Ciszewska K.	WETLAND	CVM	1995	Biebrza wetlands
Muszyńska J.	DRINKING WATER I	CVM	1996	Quality of tap water and water from wells
Bartczak A.	DRINKING WATER II	TCM	1996	Quality of tap water and water from wells
Borkowska M., M. Rozwadowska, Śleszyński J., Żylicz T.	HOUSES	HPM	1999	Air quality, noise, green areas and house market
Panasiuk D.	LANDSCAPE	TCM	2000	Landscape, fauna and flora
Dziegielewska D.	AIR QUALITY	CVM	2000	Air quality, morbidity, mortality, cultural heritage and ecosystems
Markowska A.	SURFACE WATER I	CVM	2003	Surface water and tap water
Markowska A.	SURFACE WATER II	CVM	2003	Surface water and tap water
Zięzio J.	FOREST	TCM	2003	Primeval forest and biodiversity

Based on WUDES (2004).

Table 9: Short Description of the Non-market Valuation Studies in Poland.

Acronym	Description of study
SEA WATER I	This pilot study was carried out as part of a larger experiment valuing losses due to the eutrophication of the Baltic Sea which was performed in Poland, Sweden and Lithuania and later extrapolated to all the Baltic countries. The pilot study included a short scenario with information on the poor condition of the Baltic Sea due to pollution coming from industry, municipal sector and agriculture.
SEA WATER II	This study was carried out as part of a larger experiment valuing losses due to the eutrophication of the Baltic Sea which was performed in Poland, Sweden and Lithuania, and later extrapolated to all the Baltic countries. The main study included a short scenario with information on the poor condition of the Baltic Sea due to pollution coming from industry, municipal sector and agriculture.
SEA WATER III	This mail study was carried out as part of a larger experiment valuing losses due to the eutrophication of the Baltic Sea which was performed in Poland, Sweden and Lithuania, and later extrapolated to all the Baltic countries.
WETLAND	The Biebrza wetland is one of the largest and the most natural bog areas in Europe. Since 1993 it has become Poland's largest national park. A special tax was proposed in this study to save the natural state of the wetland area.
DRINKING WATER I	The study aimed at valuation of water provided free of charge in wells in Warsaw where clean drinking water is pumped from Oligocene wells.
DRINKING WATER II	The study aimed at valuation of water provided free of charge in Warsaw in wells where clean drinking water is pumped from Oligocene wells.
HOUSES	The paper reports on a 1999 survey of prices of family houses and apartments in the metropolitan area of Warsaw, Poland. A series of hedonic price models were estimated in order to determine whether the prices reflected such environmental amenities as green neighborhood, clean air or low noise.
LANDSCAPE	The objective of the study was the presentation of costs and benefits associated with the construction of the Czorsztyn reservoir in the Pieniny National Park.
AIR QUALITY	This study estimates WTP to avoid damage related to air pollution. The possible damage due to air pollution were divided into eight components: mortality, bronchitis, asthma, minor health symptoms, visibility loss, material damage, damage to historical buildings and monuments, and ecosystem damage. In addition, two scenarios were presented to the respondents: a 25% and 50% reduction in air pollution.
SURFACE WATER I	This study was carried out as the first stage of a larger project aimed at valuation of benefits from implementing in Poland the Directive 91/271/EC concerning municipal wastewater treatment. In this study, improved surface water quality in Poland expected as a result of the new regulations was valued together with an improved tap water quality.
SURFACE WATER II	The aim of this study was to evaluate benefits from implementation of the Directive 91/271/EC concerning municipal wastewater treatment. The main effect expected after implementing the directive would be higher quality of surface water in Poland (rivers and lakes).
FOREST	The aim of this study was to estimate the tourist value of the Bialowieza Primeval Forest.

Based on WUDES (2004).

Table 10: Survey Characteristics and Description of Environmental Change in the Polish Non-market Valuation Studies.

Acronym	Survey characteristics	Environmental Change
SEA WATER I	representative; nation-wide sample; face-to-face; n=1,116	Providing clean beaches with swimmable water, plants and animals compared to sea polluted due to industry, municipalities, agriculture
SEA WATER II	representative; nation-wide sample; face-to-face; n=1,162	Replacement of beaches affected by eutrophication with clean beaches with swimmable water, fauna and flora
SEA WATER III	nation-wide sample; survey mailed to 600 adult Poles; only 304 responded	Reducing of eutrophication effects in the Baltic Sea
WETLAND	nation-wide sample; face-to-face; n=1,171	Conservation of the natural state of the Biebrza Wetlands National Park
DRINKING WATER I	Warsaw citizens who come to 15 water wells to get water; face-to-face; n=1,200;	Valuation of high quality water available free-of-charge in the wells opened for public
DRINKING WATER II	Warsaw citizens who come to 15 water wells to get water; face-to-face; n=1,200;	Valuation of high quality water available free-of-charge in the wells opened for public
HOUSES	Warsaw real estate market; n=982	Impact of air quality, noise and green areas on housing prices in Warsaw
LANDSCAPE	visitors of the Pieniny National Park; face-to-face; n=1,281	1. Changing the landscape, local climate and losses in flora in the Pieniny National Park due to a dam; 2. Tourist value of the Pieniny National Park
AIR QUALITY	representative; nation-wide sample; face-to-face; n=1,055	25% and 50% reduction in air pollution (50% would roughly correspond to meeting EU standards)
SURFACE WATER I	representative; nation-wide sample; face-to-face; n=1,016	Changing the water quality of most of rivers and lakes in Poland with bad water to allow fishing and bathing, and all tap water would be of high quality.
SURFACE WATER II	representative; nation-wide sample; face-to-face; n=952	Changing the water quality of most of rivers and lakes in Poland with bad water to allow fishing and bathing, and all tap water would be of high quality.
FOREST	visitors of the Bialowieza Primeval Forest National Park; face-to-face; n=1,012	Extension of the protected zone of the Bialowieza Forest National Park to the entire primeval forest.

Based on WUDES (2004).

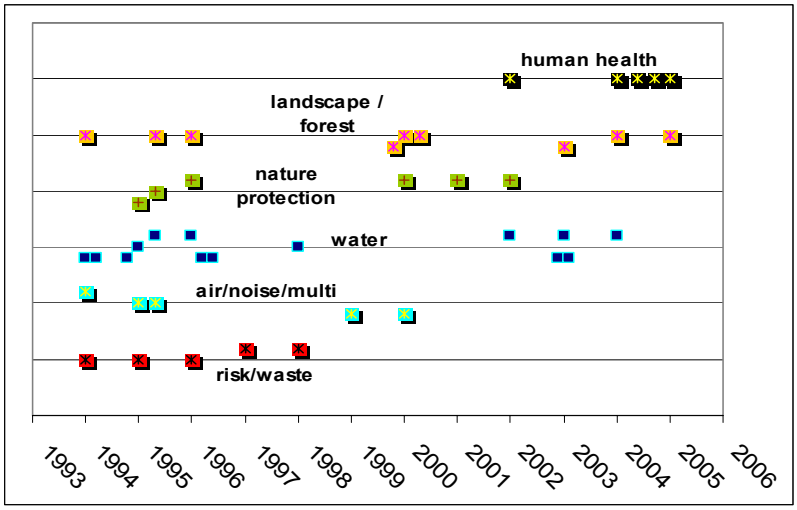
Table 11: Study Results and Description of the Payment Vehicle in the Polish Non-market Valuation Studies.

Acronym	Payment vehicle and elicitation question format	Results
SEA WATER I	Earmarked tax (annual); Open-ended question	WTP values (mean) expressed in PLN/person/year: Only positive bidders WTP PLN 41; Positive and zero bidders, excluding protesting respondents WTP PLN 32; Positive bidders, legitimate and protesting as zeros WTP PLN 20
SEA WATER II	Earmarked tax (annual); Dichotomous Choice question (8 random bids)	WTP values (mean) expressed in PLN/person/year Mean value: Only positive bidders WTP PLN 170; Positive and zero bidders, excluding protesting respondents WTP PLN 129; Positive bidders, legitimate and protesting as zeros WTP PLN 104
SEA WATER III	Earmarked tax (annual); Dichotomous Choice question (8 random bids)	WTP values (mean) expressed in PLN/person/year: Only positive bidders WTP PLN 487; Positive and zero bidders, excluding protesting respondents WTP PLN 236; Positive bidders, zero and protesting as zeros WTP PLN 185
WETLAND	Earmarked tax (annual); Dichotomous Choice question (8 random bids)	WTP values expressed in PLN/person/year: Positive bidders only WTP PLN 174; Positive and zero bidders, excluding protesting respondents WTP PLN 85
DRINKING WATER I	1. Fee per liter of water paid at the well; 2. Fee per liter of water according to water meter at home; 3. A flat rate per month added to utility bills; Dichotomous Choice question (8 random bids)	WTP expressed in PLN/liter: Only positive bidders (scenario 1): PLN 0.94, (scenario 2): PLN 1.06; Positive and zero-bidders, protest bidders excluded (scenario 1): PLN 0.73, (scenario 2): PLN 0.96
DRINKING WATER II	Direct and indirect travel costs	The average cost of 1 liter of water: PLN 0.084
HOUSES	Price offer	
LANDSCAPE	Travel costs	The annual tourist value of the Pieniny National Park was estimated at 140,000,000 PLN.
AIR QUALITY	Earmarked tax (annual); CVM with both dichotomous choice and open-ended questions	WTP expressed in PLN/person/year (median) - Removed protest respondents: 1. Lognormal maximum-likelihood model (25% reduction) PLN 132.9; (50% reduction) PLN 152.6; 2. Generalized estimating equations (25% reduction) PLN 128.9; (50% reduction) PLN 159.6
SURFACE WATER I	Higher water and wastewater treatment fees; CVM with an open-ended question	The average WTP per household per month: PLN 10.04
SURFACE WATER II	Higher water and wastewater treatment fees; CVM with an open-ended question	WTP expressed in PLN/month/household: 1. Positive respondents only: (surface water) PLN 5.42; (tap water) PLN 5.56; 2. Positive and zero-respondents, excluding protesting respondents: (surface water) PLN 6.51; (tap water) PLN 6.72
FOREST	The sum of out-of-pocket payments for travel, accommodation and tourist attractions (annual)	The annual value of the Bialowieza Primeval Forest equals about 16 million PLN taking into account all the tourists.

Based on WUDES (2004).

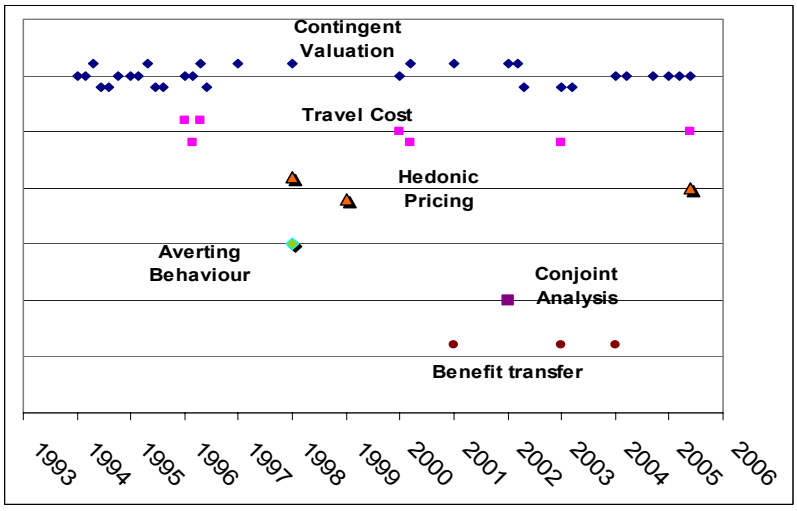
Appendix 3: Review of the non-market valuation studies applied in the Czech Republic, Hungary and Poland.

Figure 6: Research Area and the Year of the Valuation Research in the CR, HUN and POL.



Note: Multi-purpose surveys by Sejak (LIMESTONE) aimed on air pollution, landscape amenities provided by forest and biodiversity, by Borkowska (HOUSES) aimed at air quality, noise and green areas in the case of housing market and by Dziegielewska (AIR QUALITY) aimed morbidity and mortality impacts, cultural heritage and ecosystems due to air pollution. Hungarian studies are recorded above the line, Polish studies below the line and Czech studies just on the line.

Figure 7: Non-market Valuation Method and the Year of the Valuation Research in the CR, HUN and POL.



Note: Hungarian studies are recorded above, Polish studies below and Czech studies just on the line.