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66

Tobias Börger

**Social Desirability
and Environmental
Valuation**

PETER LANG

Frankfurt am Main · Berlin · Bern · Bruxelles · New York · Oxford · Wien

Social Desirability and Environmental Valuation

Hohenheimer Volkswirtschaftliche Schriften

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III. Abbreviations

ABCM	Attribute-based choice modeling
CBA	Cost-benefit analysis
CE	Choice experiments
CEG	Citizen expert group
Coeff.	Coefficient
CVM	Contingent valuation method
DC	Dichotomous choice (elicitation format)
BIDR	Balanced Inventory of Desirable Responding
BMBF	German Federal Ministry of Education and Research
EDR	Environmentally desirable responding
EDRS	Environmentally desirable response scale
GBP	Great Britain Pound
GDP	Gross domestic product
GIS	Geographical information system
IM	Impression management
LILAC	Sino-German research cooperation “Living Landscapes – China”
LUCC	Land-use cover change model
MEP	Ministry of Environmental Protection (of the PRC)
MMPI	Minnesota Multiphasic Personality Inventory
MOST	Ministry of Science and Technology (of the PRC)
NEP	New environmental paradigm
NGO	Non-governmental organization
NOAA	(United States) National Oceanic and Atmospheric Association
NRWNNR	Naban River Watershed National Nature Reserve
OE	Open-ended (elicitation format)
OLS	Ordinary least squares
PC	Payment card (elicitation format)
PRC	People’s Republic of China
PVM	Participatory valuation method
RMB	Renminbi (Chinese currency)
RUM	Random utility model
SD	Social desirability

SDR	Socially desirable responding
Std. error	Standard error
SED	Self-deception
SEU	Subjective expected utility
TEV	Total economic value
WTA	Willingness to accept
WTP	Willingness to pay

Chapter 1

Introduction

1.1. Motivation and objective of the study

The economic valuation of environmental goods is an important tool of rational public policy in the environmental sector. Over the last decades, this topic has been fervently debated because on the one hand output of such valuation exercises is needed by policy makers, but on the other hand a variety of methodological shortcomings have not yet been remedied. Political decision makers are in need of estimates of the value of environmental goods in order to contrast them to the overall costs of policy measures resulting in the provision of such goods. For example, the prevention of water pollution by closing down factories emitting chemical waste into lakes or rivers or fencing off a forest area against timber production in order to preserve habitat for certain plant and animal species are directly associated with economic costs. Affected companies have to reduce or even completely shut down production, and workers might have to be laid off and compensated, usually from the public budget. In addition to that, government uses public funds to initiate and administer projects of this kind which induce an improvement of environmental quality. So, from a more general point of view, public projects which lead to the provision or preservation of environmental resources are costly. Firstly, such projects are often associated with forgone economic gains due to reduced or more costly production as a result of more stringent environmental standards and regulations. Secondly, direct costs arise for the public budget because such projects have to be administered and compliance to new regulations has to be monitored and enforced when necessary. At the same time, such projects create benefits accruing to society. As the foundation for all human life, the state of the natural environment is one of the major factors affecting the well-being of individuals and societies. The natural environment is the basis for the production of food and other agricultural goods, for fishing and the extraction of inorganic natural resources. At the same time, people directly enjoy breathing clean air or swimming in a natural lake. Others go hiking to enjoy the view of a mountainous landscape, yet others feel happy about the mere knowledge of the existence of certain plant and animal species or ecosystems although they never in their lifetime visit these areas. These examples illustrate that the natural

environment benefits society through a variety of different channels. All the above aspects of natural resources are labeled environmental goods, and this study is concerned with the valuation of such goods.

Public projects in the environmental sector aim at the preservation or further creation of such environmental goods. Yet, in order to assure the most efficient use of public funds, government should only implement those public projects the benefits of which exceed the costs. Similarly, if government has the choice between several projects, it should initiate that project with the most favorable benefit to cost ratio first. This is the fundamental idea of cost-benefit analysis (CBA) of public projects, which should be done prior to their implementation. But while the quantification of the costs of such projects is relatively straightforward, the valuation of the benefits is unequally more burdensome. The major difficulty about valuing such benefits is that there is no market where environmental goods are bought and sold. Environmental goods generally fall into the category of nonmarket goods. This fact stems from the public good nature of environmental resources, i.e. that nobody can be excluded from their consumption and that this consumption is often also non-rival. For the case of ordinary private goods, the market price serves as an indicator of the value of that good, i.e. the utility that its consumption generates for a certain individual or household. The price that the household is willing to pay in order to purchase that good is equal to the monetary value of the minimum utility that it derives from it. If the price is higher than the utility of consuming that good, the household – assumed it is a rational decision-maker – will not purchase it because the utility gain from consuming the good will not completely compensate for the loss in utility resulting from spending money for the purchase. Consequently, from the fact that one can observe households actually purchasing certain goods at observable market prices, one can derive the change in utility that the consumption of this good leads to. However, for the case of environmental goods such markets do not exist and therefore no market transactions or market prices can be observed. As a consequence, other means of assessing the changes in utility that these goods induce have to be found; otherwise it would not be possible to conduct a CBA of a public project involving the provision of nonmarket goods, or environmental goods in particular. This is the point where the much debated economic valuation of environmental goods enters the stage.

Among a variety of methods for the valuation of nonmarket goods the contingent valuation method (CVM) is the most prominent and most frequently employed technique. The overall objective of the CVM is the assessment of the utility changes of households resulting from a public project that leads to the provision of an environmental good and the subsequent aggregation of these changes to calculate the social value of that

good. It was mentioned above that for the case of ordinary market goods, the price that a household is willing to pay in order to purchase that good is equal to the monetary value of the minimum utility that it derives from its consumption. The CVM takes up this idea and constructs a hypothetical market situation where an environmental good can be bought in order to assess households' utility changes resulting from consuming that good. Therefore, the CVM is a survey-based technique, according to which a sample of households representative for the total population affected by a certain environmental project is confronted with that hypothetical market. In such survey interviews, which can be conducted in-person, by telephone, mail or on the internet, a hypothetical public project inducing a change in the level of provision of an environmental good is presented to the responding households. Subsequently these households are asked how much money they are willing to pay in order to have this project realized. If the change in the level of provision of the environmental good is positive, households are either asked their willingness to pay (WTP) to receive the benefits accruing from that provision, or their willingness to accept compensation (WTA) for forgoing the additional benefits resulting from that good. The idea behind the statement of WTP is that a household is willing to pay at most that amount of money for the environmental good that makes it exactly as well off as before the good was provided. Analogously, if an environmental good is not provided, the WTA is that amount of money that would generate exactly as much utility as the provision of that good would have. Defined this way, such statements of WTP or WTA can be interpreted as a household's Hicksian Compensating Variation (CV). They are measures of the utility changes that a certain household experiences from the consumption of an environmental good.

For the CVM to elicit meaningful statements of either WTP or WTA it is necessary that the hypothetical market situation in the interview resembles a real market situation as closely as possible. This is largely because unlike in an actual market transaction, in a CVM interview the respondents do not have to make real economic commitments, i.e. they do not have to actually make a payment. This is why the CVM is classified as a so-called stated preference approach. Individuals do not reveal their preferences for certain environmental goods by actual behavior but merely by a statement of how much they are willing to pay for the consumption of that good or willing to accept compensation in order to forgo the consumption of it. Stated preference techniques and the CVM in particular provide data which cannot be generated otherwise due to the nonmarket nature of environmental goods, but also face severe methodological problems. To begin with, people are usually not familiar with the task of stating a WTP for an environmental good. Normally, before buying a private good, consumers gather information, com-

pare it to similar goods and actively evaluate the prospective change in utility that will result from consuming that good. This is not the case for public goods and especially environmental goods. These are normally centrally provided by government, so people do not have to make decisions whether or not and how much of such a good they want to consume. In a CVM interview, however, they are confronted with just this situation. They have to decide how much of their income they are willing to give up in order to consume the quantity of the environmental good specified in the hypothetical project description. In addition to that, in a CVM interview respondents cannot actively gather more information in case they need it. Instead the responding household merely takes a passive role and has to base its WTP statement on the information that the interviewer provides.

The discussion of these flaws leads to another – perhaps the most important – methodological problem of stated-preference methods, and CVM in particular: response bias. This procedural shortcoming stems from two underlying characteristics of this method. Firstly, no real market transactions are carried out, and secondly, the WTP has to be stated in some kind of social interaction. That means, unlike in a real market transaction, the focus of this action is not on the exchange of money for a consumption good but rather on the statement of an intention, which is – at least for the duration of the interview – without immediate material consequence. When respondents only have to state verbally what they would do under certain circumstances, the costs of deviating from a truthful response are very low. Even with untruthfully responding to a WTP question in a contingent valuation interview can a respondent expect to be provided with the level of the environmental good that is specified in the hypothetical scenario. Such a deviation from truthful reporting is especially likely when the respondent perceives the hypothetical nature of her response and thus concludes that her statement does not have any consequences for the outcome of the survey anyway. Although there is a branch of CVM research that deals with increasing the consequentiality of the WTP statement as perceived by a respondent, this condition is not necessarily fulfilled. In contrast to this, the deviation from acting according to one's true preferences in a real market situation would result in buying a good which the household does not really want in the first place. That means it would definitely be consequential. So, it becomes clear that stated preference methods such as the CVM allow for both deliberate and accidental misreporting of preferences as a result of the hypothetical nature of the question.

Reasons for such misreporting can be the pursuit of other objectives that arise from strategic motives or from situational factors of the interview procedure. An example for a strategic motive to misreport in a valuation survey is to state a WTP that is higher than one's true valuation in order to

influence the result of the survey. If the respondent knows (or at least expects) that the implementation of the proposed environmental project is contingent on the sum of all WTP statements elicited in the survey to exceed a certain amount, such as the costs of the project, there is incentive to falsely state a higher WTP. Another type of misreporting is the deliberate statement of zero in order to express protest against the environmental project or the valuation method itself. Situational motives for deviating from stating one's true WTP are rooted in the social interaction of the interview process. It is evident that the immediacy of the social interaction varies with the mode of administration of the survey. The in-person interview certainly constitutes the most immediate form of social interaction between interviewer and respondent, but even in mail or internet-based surveys does the respondent feel that there is some addressee that is going to evaluate the WTP responses. When situational factors enter the set of motives for the statement of a certain WTP, its original factors, i.e. the true preferences of a household for an environmental good, might take a backseat. This is what is referred to as response bias: factors other than the actual question stimulus "How much are you willing to pay to get that specific good?" determine the final response. One conceivable situational factor is a respondent's desire to be in accordance with prevalent social norms when stating the WTP. This phenomenon is called socially desirable responding (SDR) and constitutes the focus of this study. According to the concept of SDR, certain respondents to a survey are rather concerned with seeking social approval from the interviewer or some other person that perceives her answers than with responding truthfully to the survey questions. Such respondents are very dependent on the expected evaluation of their answers by another person or institution. The motivation of such respondents is rather the urge to immediately satisfy their need for social approval by stating a WTP which they think is socially desirable than to report their true WTP.

The likelihood of the occurrence of SDR with regard to WTP questions in contingent valuation surveys is rather high for three reasons. Firstly, CVM surveys constitute what sociologists call surveys dealing with 'reported behavior'. In situations where a certain pattern of behavior of an individual can for some reason not be directly observed by the researcher, that individual can simply be asked how she would behave in that situation. Such a technique constitutes a time- and resource-saving shortcut to analyzing individual behavior. This exactly describes stated preference surveys such as the CVM, because a household's preferences for an environmental good cannot be inferred by its purchases of that good due to the lack of a respective market place. Instead, the household is asked to verbally state its preference for that good. Sociology finds responses to this type of survey to be very prone to be influenced by SDR. The response to the WTP question in a

contingent valuation survey is also a self-report of intended behavior in a certain situation. Biasing the response to this question in order to appear in a better way in front of the interviewer is not associated with an actual change in behavior, so it is easily done and thus very likely to happen. Secondly, in times of increasing environmental concern, today's societies are characterized by more and more pronounced social norms regarding environmental protection. In many areas of life, social norms associated with the protection and conservation of environmental resources influence individual behavior. Consequently, environmentally friendly behavior and attitudes are regarded as good and thus as desirable by an ever increasing number of people. The WTP question in a CVM interview asks for a household's contribution to some public project leading to an improvement of environmental quality. Therefore, it is very likely that the respondent perceives strong social norms that call for an 'environmentally friendly' response. It can thus be expected, that a certain fraction of respondents rather state a WTP that they think is socially desirable than what equals their true valuation for the proposed environmental good. Altogether, the hypothetical nature of the WTP question in contingent valuation surveys of environmental goods and the existence of clear-cut social norms in this field make an occurrence of SDR very likely. Finally, the socio-cultural positioning of the survey reported on in this study immediately suggests investigating the influence of SDR. The empirical part of this study deals with a practical contingent valuation survey in a small town in Southwest China. It is expected that the cultural and political background of the People's Republic of China (PRC) may serve very well to investigate the SDR phenomenon. Reasons for this are the Eastern, Confucian culture and the socialist and authoritarian political system in the PRC. On the one hand, Chinese culture emphasizes the notion of face, i.e. some form of prestige that an individual must preserve in front of others. This stresses the importance of situational factors in a survey interview at the expense of the truthful reporting of preferences. On the other hand, the current political system of the PRC has not been offering its citizens much room for actively stating individual preferences regarding public projects. Therefore, it is very likely that many respondents rather feel urged to support public opinion towards such projects instead of truthfully revealing their own preferences. Since this is a form of socially desirable responding, the investigation of this phenomenon within the framework of a contingent valuation survey in China appears highly advisable.

So far, there are plenty of studies that hint at the fact that SDR affects the results of contingent valuation surveys. These studies mostly find that the perceptibility of WTP statements by individuals other than the respondent increases the amounts of such statements (e.g. Alpizar et al. 2008a, Leggett et al. 2003, List et al. 2004). Such studies compare mean WTP estimates elicited

by different survey modes. A usual finding is that in-person surveys yield higher WTP estimates than mail surveys or situations where WTP responses can be written down and be slipped into a sealed ballot box. Obviously, the fact that the WTP response can be perceived by the interviewer might bias it upwards. So, apparently social pressure influences survey responses. In addition to that, another set of studies make out that characteristics of the appearance of the interviewer systematically influence the statements of WTP (e.g. Bateman and Mawby 2004, Loureiro and Lotade 2005). It can be shown that for instance the formality of the interviewer's dress or the relationship of the good to be valued and the obvious origin of the interviewer significantly increases WTP statements. This phenomenon goes by the name of interviewer effects and apparently constitutes a major situational factor that may lead to the misreporting of WTP statements. All of these studies presume that a specific characteristic of the interviewer is likely to activate a social norm in the respondent, so that the latter feels compelled to act in compliance with this norm. This in turn constitutes socially desirable responding. In many of the above studies, SDR is mentioned as a biasing factor of WTP statements and the reported mode and interviewer effects, respectively, are interpreted as empirical evidence for this. However, these results are rather selective and a consistent analysis of the effect of SDR in contingent valuation surveys is still lacking. At most, these findings hint at the influence of SDR but do not constitute direct proof of its existence. Instead, they rather demonstrate that both the level of anonymity perceived by the respondent and the existence of social norms (conveyed through certain features of the appearance of the interviewer) have a significant impact on the statement of WTP for environmental goods. To be quite exact, these types of empirical work do not constitute sufficient evidence of the biasing influence of SDR in CVM surveys.

While most of these CVM studies presume that SDR is potentially biasing the WTP statements, surprisingly little direct research regarding this phenomenon can be found in the relevant literature. Although socio-psychological research has developed means to assess an individual's tendency to respond to survey questions in a socially desirable manner, merely one study attempts to directly measure this phenomenon and relate it to WTP statements (Laughland et al. 1994). Yet, this study has a rather one-dimensional perspective on the concept of SDR and fails to account for the variety of factors that might be at its root. This is where the present study wants to fill a gap in CVM research: the idea of SDR as a multi-component concept and the attempts to directly assess the tendency to respond in a socially desirable manner have to be combined in order to test the influence of this response bias on WTP statements. To this end, the present study pursues two main objectives. Firstly, a behavioral model will be developed that allows for the

inclusion of different factors of socially desirable responding. As the above findings suggest, this phenomenon does not merely have one source but might rather be triggered by a set of factors. Based on the theory of rational choice, this study will present a behavioral model that can be used to predict the exact set of constraints within which the validity of CVM survey data is impaired. As a second objective, tools for the empirical assessment of these factors, i.e. of the different components of SDR as specified by the theoretical model, will be developed, tested and applied in a practical survey. This includes both the modification of existing question inventories and the creation of new questions. Before employing these questions in a contingent valuation survey, it has to be scrutinized whether they produce reliable and valid assessments of the theoretical components of SDR. It can be expected that respondents differ to the degree that they are influenced by what they perceive as socially desirable. Additionally, different respondents might also have different ideas of what is socially desirable. So, these assessment tools aim at the identification of those different types of respondents. By assessing a respondent's tendency to respond in a socially desirable way to the WTP question in a contingent valuation interview, the theoretical predictions regarding the composition of factors of SDR can be tested empirically. Therefore, the overall aim of this study is to scrutinize the importance of SDR as a biasing factor in contingent valuation surveys in a comprehensive way.

A note regarding the interdisciplinary nature of this research plan is appropriate at this point. Obviously, SDR is not merely a problem of survey-based environmental valuation and the CVM but of survey research in general. Consequently, research in this field has mostly been pushed on with by sociologists (mostly regarding survey methodology) and psychologists (concerning the definition of the behavioral concept of SDR). Therefore, the mere economic perspective on contingent valuation has to be broadened by integrating theoretical concepts and practical approaches from both sociological and psychological research. This is a secondary objective of this study. Integration in this respect does not mean that it is intended to write a socio-psychological study. Instead, theoretical concepts originating from outside the field of economics shall both be scrutinized from the point of view of economic theory and eventually be employed to explain response behavior in a CVM survey. Since all three disciplines mentioned above strive for an explanation of human behavior, it will be both possible and necessary to interrelate similar concepts at different points in the course of the study. In addition to that, methods originating in experimental research of psychology and behavioral economics will be applied. By employing an experimental approach, certain situational characteristics of the interview can deliberately be modified. In doing so, the effect of these modifications on response behavior and on WTP statements in particular can be isolated. This allows

for a more flexible investigation of the impact of situational factors on WTP responses, which is expected to be closely linked to incentives for SDR. Altogether, it is believed that by applying this interdisciplinary approach the situational and interactional nature of the CVM interview can be better taken into account, and consequently more reliable and valid valuations of environmental goods can be produced by this method.

1.2. Outline of the study

Following this introductory chapter, chapter 2 presents the concept and methods of environmental valuation with a particular focus on the contingent valuation method. After introducing the basic mindset of and providing rationales for environmental valuation, the concept of total economic value is discussed and the welfare economic background of the valuation of environmental resources is reviewed. This is the basis upon which different valuation methods are introduced. One of these methods – the CVM – is characterized in more detail because it is the method of choice for the empirical analysis reported on in this study. Issues such as questionnaire design, administration modes and question formats as well as the scientific exposition of certain procedural biases are introduced. This includes a discussion of several current problems, criticism and developments of the method, which are important for the research program of this study. The chapter ends with a review of econometric approaches to estimate the social value of environmental amenities based on contingent valuation data.

Subsequently, chapter 3 provides a profound discussion of the concept of socially desirable responding both from the socio-psychological and sociological point of view. The first part of this chapter deals with the definition of the concept of SDR and adequate tools for its measurement. This issue is tackled from two perspectives. On the one hand, the psychological research in this field is introduced. In the last six decades psychologists working on SDR have mainly been focusing on the personality psychological definition of this concept and on the development of question inventories which are able to assess the degree to which an individual's survey responses are biased by it. The different components of the phenomenon identified by the researchers can be separated according to the questions of who is the addressee of socially desirable response behavior and how a socially desirable picture of the self is conveyed to the interviewer. Sociological research on the other hand has rather concentrated on the question of the dimensionality of the SDR concept. While psychological research focuses on determining the nature of the components, sociologists rather ask how these components are

related and how strong their influence is on other variables assessed in a survey. A subsequent discussion of the role of social norms for SDR provides the rationale for an analysis of this response bias in the field of contingent valuation. It will be demonstrated that social norms define what kind of survey responses are socially desirable and which are not. It will become clear that especially regarding environmental protection in today's society strong behavioral norms are at work. Consequently, SDR can be expected to be a serious problem when applying the CVM. In the last part of this chapter, the idea of SDR as a multi-component concept is taken up again. Based on the theory of rational choice a behavioral response model will be developed which is able to integrate different factors into one concept referred to as incentives for socially desirable responding. Both the selection of factors and the specific form of their relationship is determined by means of that model. The analysis of the influence of the variable "incentives for SDR" resulting from this rational choice model on responses in contingent valuation surveys will form the central issue of the subsequent two chapters.

In chapter 4, the behavioral model of SDR developed in the precedent chapter is integrated into the CVM context. Therefore, as a first step, the relevance of SDR for contingent valuation surveys is discussed and existing empirical research on this issue is reviewed. The two main reasons why CVM research should investigate the influence of SDR are the facts that such surveys deal with so-called reported behavior and that their topics, i.e. environmental conservation and protection, are associated with increasingly strong social norms. As it turns out, the existing research on social desirability in the field of CVM is merely confined to the detection of mode effects, i.e. the finding that such forms of survey administration featuring the use of interviewers yield higher mean WTP estimates than self-administered surveys. This difference is usually attributed to SDR. However, as is argued in that section, such indirect results do not constitute sufficient evidence for the existence of SDR in contingent valuation surveys and that instead direct tests for this bias should be applied. This idea serves as justification for applying direct methods to assess incentives for SDR developed by psychologists and sociologists and test the influence of these incentives on WTP statements. If SDR is a factor affecting the behavior of individuals it is quite likely that it also affects the statement of WTP in a contingent valuation survey, i.e. that the SDR variable has a direct impact on stated WTP. In this case the incentives for SDR as specified by the behavioral model in chapter 3 can be identified as significant determinants both of the amount of stated WTP as well as of the decision whether to state a positive WTP amount at all. These are the main research hypotheses to be derived from the theoretical discussion of that SDR-WTP relationship.

The empirical analysis of those theoretical models and the test of the research hypotheses are reported in chapter 5. The framework for that analysis is a practical contingent valuation survey conducted by a subproject of a Sino-German research cooperation in Southwest China. Therefore, the chapter starts with a description of the research area, its main environmental problem and the objectives of the research cooperation in general. Massive expansion of the cultivation of rubber trees in that region have led to tremendous changes in land-use patterns and associated environmental problems such as deforestation, loss of biodiversity, and soil erosion. Within this cooperation, the subproject ECON A conducts a contingent valuation survey to quantify the social value of an alternative future land-use scenario featuring partial roll-back of rubber cultivation and subsequent reforestation.

The analysis of the influence of SDR on WTP statements in the framework of that survey consists of two main parts. Firstly, appropriate question inventories have to be found that reliably measure the components of SDR identified in the theoretical part of this study. To this end, the applicability of existing question inventories is scrutinized and modifications are undertaken where necessary. This process is accompanied by extensive documentation of the reliability and validity of the modified questions. Secondly, the hypotheses derived in chapter 4 are tested empirically. Different types of regression models are employed that relate the variables generated from the question inventories assessing the SDR components with WTP statements. After displaying the results in detail, this chapter ends with a discussion referring back to the hypotheses of the precedent chapter. Chapter 6 provides some concluding remarks and an outlook of future research in this field.

Chapter 2

The economic valuation of environmental goods

2.1. Measuring environmental values

The natural environment is the basis for all human life on earth because it provides the foundations for its existence, such as air to breathe, food, temperate climate which constitutes the atmosphere, and many more direct and indirect benefits. Through a variety of different channels the natural environment favors human life. So, in terms of economic theory, the natural environment clearly generates utility for individuals both directly by providing accurate space for their existence, and indirectly by allowing for the production of consumption and investment goods, such as food and inorganic natural resources. Those indirect and direct benefits of the natural environment can be referred to as environmental goods. The decisive difference between such goods and ordinary market goods such as furniture, food, or labor is the public good nature of environmental goods. When environmental goods are produced, i.e. when they exist in the form of an intact ecosystem, clean air, or a beautiful landscape, typically nobody can be prevented from enjoying the benefits provided by these goods. According to Samuelson (1954), this so-called non-excludability is one defining characteristic of a public good. The other characteristic of a public good, non-rivalry in consumption, is also given for many environmental goods. Benefits of a reforestation program or a program to reduce air-pollution for example can be enjoyed by everybody without diminishing the benefits for any other member of society (Samuelson 1954). Even though a pure public good that completely exhibits the two above characteristics is a merely theoretical concept, most environmental goods have clear public goods characteristics. Therefore, property rights for such goods cannot be clearly defined and as a result, markets where such goods are bought and sold do not exist. Consequently, environmental goods can be classified as nonmarket goods, so there are no market prices that would be the result of a market equilibrium, either. When the value of these obvious benefits, which environmental goods provide people and society with, cannot be quantified by means of market prices, other techniques have to be devised. Yet, before discussing ways to

value environmental goods, some reasons for their valuation, i.e. uses of the valuation estimates, are introduced.

Traditionally, the valuation of environmental goods serves the three following purposes – as quantitative input for cost-benefit analyses (CBA) of public projects, for the calculation of so-called green GDP and for environmental damage assessment (cf. Ahlheim 2003, Stephan and Ahlheim 1996). The first field of application of environmental valuation is cost-benefit analysis. Public projects in the environmental sector such as the protection or restoration of natural resources in particular, can be interpreted as a public good because the benefits accruing from such projects can be enjoyed by the whole society. In order to provide these public environmental goods, government has to allocate funds to the implementation of the above mentioned environmental projects. Of course, those projects with the highest benefit to cost ratios should be financed and implemented first. Analogously, projects the costs of which exceed their benefits should not be carried out at all. By comparing overall costs to overall benefits of a public project CBA is a means to assure the efficient allocation of public funds into government projects. While the costs of such a project can be calculated in a very straightforward manner, the assessment of their benefits especially in the environmental sector is incomparably more burdensome. The reason for this is the public good nature of environmental goods and the fact that no market prices exist that could be used as value indicators. The costs of for example a reforestation program include categories such as planting new trees and income losses of farmers resulting from forgone agricultural or industrial use of the reforested land. The benefits on the other hand would comprise aspects as different as positive effects on microclimate, the conservation of plant and animal species and the preservation of landscape beauty and recreation possibilities for visitors of the reforested area. Since such benefits are public goods which are not traded in markets and thus do not have market prices, other techniques for their valuation have to be found. This is where environmental valuation enters the stage and provides valuations of environmental goods as input for cost-benefit analyses of public projects in the environmental sector.

The second use of environmental valuation data is for the calculation of green gross domestic product (GDP). Economic development in the form of production growth is usually associated with deterioration of environmental quality and exploitation of natural resources. Therefore, only reporting the strictly economic performance of a society as expressed in the classical form of GDP as an account of all goods and services produced in one economy in a certain period of time neglects the changes in the natural capital stock. Only if these changes are assessed and accounted for in the overall (green) GDP does this represent a complete description of the state and development of