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IV. Abbreviations

16 PF	16 Personality factors
ABCM	Attribute-based choice modelling
ABM	Averting behavior method
BFI-10	10-item Big Five inventory
BFI	Big Five inventory
BFM	Big Five personality model
CBA	Cost-benefit analysis
CJ	Citizen jury
CV	Compensating variation
CVM	Contingent valuation method
DC	Dichotomous choice (elicitation format)
DFG	Deutsche Forschungsgemeinschaft (German Science Foundation)
EFA	Exploratory factor analysis
EV	Equivalent variation
HDM	Hedonic price method
MMPI	Minnesota Multiphasic Personality Inventory
MRW	Mae Rim Water Works
MS	Market stall
NEO-FFI	NEO five factor inventory
NEO-PI-R	NEO personality inventory-revised
NOAA	National Oceanic and Atmospheric Association
OE	Open-ended (elicitation format)
OLS	Ordinary least squares
PC	Payment card (elicitation format)
PCA	Principle component analysis
PVM	Participatory valuation method
RUM	Random utility model
TDM	Trait descriptive adjective
TCM	Travel cost method
WTA	Willingness to accept
WTP	Willingness to pay

Chapter 1 Introduction

1.1 Study motivation

The natural environment generates a wide range of benefits for society. It provides raw materials and energy to the economy, allowing for the production of consumption goods all of which serve our wants and needs. At the same time, the natural environment provides goods and services directly to individual citizens. The clean air we breathe, the beauty of a waterfall we enjoy, and the various ecosystem functions that support our existence are all benefits we obtain directly from the environment. All of the above direct and indirect benefits of the natural environment can be referred to as environmental goods. They are labelled as "goods" because, like ordinary market goods such as food, clothing, and cars, environmental commodities generate well-being or welfare for individuals and societies. Yet, unlike ordinary market goods, environmental commodities are very special kinds of commodities whose properties prevent them from being traded, and thereby valued, in markets.

Environmental goods often have the character of public goods. This means that when environmental goods are created, e.g. in the form of improved air quality, nobody can be excluded from consuming these goods, and that their consumption by additional individuals does not diminish the benefits to others. Since exclusion is not possible, property rights to environmental goods cannot be defined and as a result markets where such goods are bought and sold do not exist. Environmental goods, therefore, can be categorized as nonmarket goods. The absence of market for an environmental good, however, complicates the quantification of its economic value, i.e. the changes in utility that its consumption leads to. For the case of an ordinary market good, its economic value is indicated by its market value, i.e. its price. The underlying assumption is that economic agents will purchase the commodity only if the utility they gain from its consumption is at least as high as its price. In this sense, the price that individuals are willing to pay to purchase the commodity is the monetary value of the minimum utility that they can derive from that commodity. Since markets for environmental goods do not exist, neither do their market prices. As a consequence, the changes in utility that the consumption of environmental goods induce have to be assessed by other means.

The absence of market price as an indication of the benefits of environmental goods has contributed to the development of environmental valuation techniques. These methods aim at the monetary quantification of the economic value of environmental goods. Such methods

become relevant, for example, when political decision makers need estimates of the monetary value of environmental goods in order to contrast them to the overall costs of the project resulting in the improvement or conservation of such goods. The valuation techniques available can be separated into direct and indirect methods. Indirect valuation methods rely on an assumption that there be a market good that is consumed with the environmental good under consideration. Consequently, the value that environmental good can be assessed indirectly through the actual consumption behavior of the related market good. The reliance on actual market behavior, however, means that indirect valuation methods take into account only the use value of environmental goods, i.e. value people derive from the direct use of the goods. The non-use value, i.e. value that people place on environmental goods because they exist, cannot be captured by indirect valuation techniques. Direct valuation methods, which rely on surveys and require respondents to directly state their individual valuation for environmental goods, are able to assess both use and non-use values of environmental goods. Direct methods, therefore, are able to assess the economic value of a wider range of environmental commodities. Of the various direct valuation methods available, the contingent valuation method (CVM) has been the most hopeful to put behind all complications arising from the assessment of environmental goods. This method constitutes the focus of this study.

The CVM relies on extensive surveys, which can be conducted face-to-face, by mail, by telephone, or on the internet, with a representative sample of a population likely to be affected by a public project that induces a change in an environmental good. As mentioned earlier, in the private goods purchase situation, the price households pay to purchase a good is a reliable estimate of the benefits that that good generates for the people consuming it. The CVM makes use of this assumption and constructs a hypothetical market for an environmental good in order to assess the benefits that its consumption leads to. An important feature of the CVM, therefore, is the project scenario, i.e. a detailed description of the public project that leads to a change in the level of provision of an environmental good. After respondents are confronted with the project scenario, a hypothetical market setting is presented to them. In the hypothetical market setting, respondents are asked to state the maximum amount of money they would be willing to pay (WTP) in order to obtain benefits from the provision of environmental good in question. The WTPs stated by respondents represent the monetary value of the utility changes they expect from the proposed environmental change scenario. After the stated WTP of all sampled households are elicited, the mean WTPs of the representative households are calculated and extrapolated to arrive at the social value of the project.

The CVM, however, has a number of methodological shortcomings. The shortcomings of the CVM stem from its simulated market, which is not able to emulate all aspects of the private goods purchase situation. In the private goods purchase situation, individuals are able to search for information on the commodities they desire. As they are the ones who decide the time of purchase, they can take their time gathering as much information about the items in question as they want in order to make informed purchase decisions. Hands-on experience that consumers can have with the commodities under consideration can help them form preferences for such goods and thus ease their decision makings considerably. Once the purchase decision is made, consumers have to pay the defined prices in order to obtain the commodities. Since the prices that consumers pay to purchase the goods are reliable estimates of the utility they expect from the goods, individual preferences of consumers are truthfully revealed in the transaction process.

Many features of the private goods purchase situation cannot be mimicked in a CVM interview. For a start, CVM respondents do not play as active role in a CVM interview as they do in an actual market. Instead, respondents are approached by interviewers at a random hour and are asked to consider about an improvement of some environmental goods they may have never heard of before. Since the project in question does not yet exist, respondents do not have the opportunity to inspect how the planned environmental improvements would feel like. They have to rely on the materials given in the survey most of which consist of verbal descriptions and photos which may or may not suit their needs. Consequently, it is very difficult for CVM respondents to form an exact idea about the environmental project in question. On top of that, respondents in a face-to-face or telephone CVM interview are given only a relatively short period of time to consider the project scenario and to identify their true individual valuation. Given these difficulties, CVM respondents must put tremendous efforts in imagining about the project. Unless they give careful thoughts on their valuation decisions, respondents might not be able to derive the correct estimate of their individual valuation of the proposed project and report a "wrong" WTP as a result.

Apart from the shortcoming related to the formation of individual preferences, another shortcoming of the CVM is related to the truthful revelation of these preferences. As discussed above, the truthful revelation of individual preferences is not a problem in a private goods market. Rational consumers always reveal their true preferences for the commodity they desire through the price they actually have to pay to obtain that commodity. However, there is no real market transaction in the CVM. After respondents report the maximum amount of money that they would be willing to pay in order to support the implementation of an environmental project, they do not have to pay that stated amount. This means respondents' stated WTP are nothing

but a statement of intention. When respondents only have to state what they would be willing to pay without really having to pay it, the truthfulness of their answers can be easily compromised. The hypothetical nature of the CVM, therefore, allows respondents to deliberately misreport their WTP statements, which would lead to erroneous WTP estimates on the part of the researcher.

Given the procedural shortcomings of the CVM discussed above, it is therefore very important –for the CVM to produce theoretically meaningful WTP statements– to ensure that all survey participants consider the survey questions thoroughly and report them truthfully. However, these basic requirements are not necessarily fulfilled in practical CVM surveys. Over the past decades, many irregularities of the WTP statements have been detected. They include, e.g., the hypothetical bias (i.e. the divergence between the hypothetical and actual contributions for environmental goods) and the social desirability effect (i.e. the tendency of respondents to state a higher WTP answer when interviewers present). To date, explanations for the systematic biases and irregularities of the WTP responses have been proposed. Reasons have been attributed mainly to the components of the CVM survey instrument, which trigger the disturbing effects on the WTP answers. Little attention has been paid, however, to the personal characteristics of survey respondents, which may as well play an important role. This is the point where this study aims to contribute.

Research in the fields of psychology suggests that within human beings there be dispositional attributes, which determine persons' tendency to feel, think, and behave in particular ways. Over years, various different dispositional concepts have been developed and validated by psychologists who have employed such concepts to gain a better understanding of the workings of people's mind and use this understanding to explain human behavior. So when it comes to the context of the environmental valuation survey, it is very likely that within survey participants there also exists dispositional attributes. And by identifying the inner attributes of CVM respondents, we may be able to establish direct links between such attributes and various different patterns of WTP responses, and obtain a better understanding on the mental mechanisms underlying WTP response behavior. Evidence supporting the use of this approach is emerging in the literature of environmental valuation (Menges et al. 2005; Lusk et al. 2007; Frör 2008; Börger 2013). Differing dispositional attributes have been detected to systematically influence the ways respondents process complex information, form their expectations about the proposed environmental project, and the tendency to misstate their WTP answers. These insights are very important because they can guide the future design of environmental valuation surveys to better suit the psychology of WTP response behavior.

This study offers a close look at the use of dispositional attributes to better understand WTP response behavior. Although this research approach is relatively new in the context of the CVM, explaining human behavior by reference to dispositional attributes has long been a common practice in psychology (Ajzen 2005). As mentioned previously, a myriad of latent and hypothetical characteristics have been conceptualized in differing sub-fields of psychology. These include, e.g., cognitive styles in cognitive psychology (Sternberg and Grigorenko 1997; Pacini and Epstein 1999), attitudes in social psychology (Ajzen 2005), and consumer decision styles in consumer psychology (Howard 1994). The list is endless. But the construct that appears as most suitable to spearhead the investigation into the dispositional attributes of individuals is personality traits. This is because personality traits do not deal with mere fractions of people's dispositions. Whereas other dispositional concepts refer exclusively to, say, emotion or cognitive disposition of individuals, personality traits deal with dispositions of the *whole* persons (Pervin and Cervone 2010, p.7). This means that traits encompass a wide variety of mental phenomena. And many of such phenomena might play important roles in WTP decisions.

The case for using traits in the CVM seems strong for three reasons. First, traits may influence the level of cognitive efforts CVM respondents put into making their WTP decisions. It is well established that traits determine the depth of individual decision making (Matthews et al. 2009, p.357ff.). Some people may be inclined to put a great level of cognitive efforts into making decisions while others are inclined to make quick or snap decisions. If this is the case in the CVM survey, some respondents may be willing to go to great intellectual efforts to answer the WTP questions even if they have to think hard about the question while others may tend to make quick WTP decisions. Second, traits may directly determine the preferential judgments of CVM respondents. In a CVM survey, respondents' judgments on the desirability of the proposed project depend on many factors, e.g. their previous experience with the environmental goods in question, their attitude towards the goods, and their attitude towards the responsible organization. It is very likely that judgments on the desirability of the project will depend on respondents' enduring characteristics, e.g. their personality traits. Some respondents, for example, may tend to make decisions based on their enduring altruistic motivations. So these respondents are likely to assign a higher value to the environmental project than those without this characteristic. Using traits to explain WTP decision, therefore, implies that we will be able to take a direct account of some important motivations underlying WTP answers. Last but not least, traits motivate social behavior many of which could be important in the context of CVM surveys. For instance, traits determine individual difference in the ways people express their personal feelings to strangers (Doherty and Schlenker 1991; Chang et al. 2001). In a CVM

survey, especially the face to face and telephone surveys, respondents are asked to report their WTP directly to interviewers. The way respondents report their feelings to interviewers will be different from person to person. Some people may have enduring characteristics that make them susceptible to the presence of interviewers and thus may tend to misreport their WTP. Others may not be influenced by the presence of interviewers and are able to truthfully report their feelings. This implies that traits may underpin reasons for the misstating of WTP answers.

Therefore, the overall objective of this study is to analyze the usefulness of the trait concept in the context of environmental valuation using the contingent valuation method. Of special interest is the explanations trait concepts can provide on the mechanisms underlying respondents' inability to form the correct expectations about the proposed environmental project and their incentives to misstate their WTP answers. In addition, this study will attempt to propose recommendations on how the design and administration of the CVM survey should be tailored based on the psychological characteristics of its respondents.

1.2 Structure of the study

There are six chapters in this study. After this introduction, chapter 2 introduces the economic valuation of environmental changes. Its main aim is to familiarize the reader with the theory of environmental valuation and the empirical techniques used to measure the value of environmental changes. This chapter provides an important basis of this study because it highlights the gap between theory and practices of environmental valuation which this study intends to use personality theory to explain. Therefore, the first and the second parts of this chapter focus on the theory and methods of environmental valuation. In the third part, the CVM which is the method of interest to this study is put under microscope. Details regarding its survey design and the analysis of its survey data are described and then discussed. Chapter 2 culminates in the fourth part which deals with the quality of welfare estimates obtained from the CVM. This part first highlights the points where the CVM can go wrong, producing WTP estimates that deviate from the theoretically correct ones. Next, this part reviews attempts to assess the validity of WTP measures. Findings on different types of response biases including proposals on how to mitigate them are presented. Eventually, this section presents to the reader a number of studies which aim at the explicit investigation into the inner characteristics of CVM respondents in an attempt to give psychological explanations to their WTP responses. Finding suggests that the mental attributes of respondents give a better understanding on the mental mechanisms behind

their WTP statements. Chapter 2 concludes that psychological attributes of CVM respondents should be further investigated.

The aim of chapter 3 is to search for both model and method developed in personality psychology that can be used to inspect the inner attributes of CVM respondents. The first part of this chapter offers the fundamentals of personality psychology. These include the meaning of personality concept, its practical measurement tools, and empirical evidence regarding its reality and influences on behavior. This first part is important because it provides justifications why the concept of personality should at all be used to investigate mental characteristics of the CVM participants. The second part offers details on the Big Five personality model (BFM), which forms the conceptual basis for the empirical investigation of this study. The BFM posits that in every individual, there exist five core personality dimensions representing the five most important aspects of his or her identity. These aspects refer to emotional, social behavioral, experiential, attitudinal, and motivational aspects (Goldberg 1990; John and Srivastava 1999). Because they represent the five psychological "pillars" of persons, the five personality dimensions are expected to underpin people's decisions and behavior in many different situations. This includes when they are making valuation decisions in a CVM survey. The second part of chapter 3 goes into great detail how the BFM is developed. The focus is put on one specific model of the BFM which has been widely accepted by psychologists. Within this particular framework, each of the five personality dimensions or "domains" is described with six subsidiary traits or "facets." As the section unveils, it becomes clear that these 30 facets give both width and depth to the meanings and the workings of the five personality domains. Most importantly, however, these facets are dispositions in their own right and thus they form a squad of meaningful traits many of which may provide fine-tuned insights into the psychological processes underlying WTP response behavior. At the end of this part, specialized tools devised to measure the five personality dimensions and their corresponding facets are introduced. Their validity, especially in the cross-cultural and cross-countries contexts, is discussed.

The aim of chapter 4 is to establish theoretical links between the five domains and the WTP response patterns. For this purpose, facets constituting each of the five personality domains are subjected to WTP response behavior, and theoretical anticipations on how these facets affect the stated WTP are made accordingly. These specific effects of facets on the stated WTP, which can be perceived as the different channels through which their domains can affect WTP statements, are then used to formulate theoretical predictions on the domain level. To date, this is the first economic study that takes a full advantage of this theoretical facet structure underlying the five personality dimensions. Outcome is a rich analysis. Based on facets, it is

conjectured that various, and different sets of, personal attributes are at work when respondents are 1) forming their expectation on the proposed project scenario and 2) stating their WTP answers to interviewers. Both positive and negative influences of dispositional characteristics on the different processes of WTP decision makings are anticipated.

The objective of chapter 5 is to test the theoretical predictions made in chapter 4 with respect to the effects of the five personality domains and facets on people's WTP decisions. The first section addresses details on the empirical surveys, i.e. backgrounds of the research project, the CVM survey design, and the practical realization of the surveys. In total, two practical CVM studies were completed in Chiang Mai, northern Thailand. Both CVM studies assessed people's WTP for the improvements of their household tap water quality. The surveys were carried out in the framework of international research collaboration program SFB 564 and funded by the German Science Foundation (DFG). In the surveys, respondents were presented with the main CVM questionnaire and another questionnaire specially designed to measure the five personality domains and facets. Results of the surveys are presented in the second part. Chapter 6 summarizes and concludes the study.

Chapter 2 Environmental valuation

This chapter is organized into five sections. The first part gives a review on the theories that form the backbones of environmental valuation. It offers the rationale for environmental valuation explaining why the well-being generated by the environment is unknown and why it should be measured. It becomes apparent that environmental goods have two crucial properties in this respect, namely non-excludability and (some of them) non-rivalry in consumption. Because of these properties, environmental assets have no market prices from which their true values can be inferred. Next, this section elucidates all possible channels through which the environment can create well-being to individual members of society. The concept of total economic value and two major classes of environmental values, i.e. the use and non-use values are introduced. The section then proceeds to the theoretical instruments designed to assess people's welfare changes resulting from the changes of the states of the environment. The so-called Hicksian Compensating Variation, which is a theoretical welfare measure that underpins major valuation techniques, is presented. The second part of this chapter reviews practical environmental valuation approaches. Various valuation methods including their advantages and disadvantages are exhibited. The section shows that only a class of methods, the so-called direct valuation techniques, are able to assess both use- and non-use values of the environment and are consequently appropriate to be used in valuation practices. The most widely employed direct valuation technique, the contingent valuation method, which will also be the focus of this study, is described in detail in the third section. As a survey-based method, the core elements of the contingent valuation method are its survey and questionnaire design. Thus, details on its survey procedure as well as questionnaire design are given. The fourth section scrutinizes the validity of valuation methods with a specific focus on the contingent valuation method. Studies using various validity criteria are reviewed. Studies employing a psychological approach to investigate the methodological shortcomings of the valuation methods are presented at the end of the fourth section. It becomes apparent that such an approach can give considerable insights into many types of response behavior in contingent valuation surveys. The last section is the chapter summary.

2.1. Theoretical foundations

2.1.1 Environmental valuation: Rationale

One of the most frequently asked questions about environmental valuation is: why do we need to do it? To answer this question it must first be reminded that environmental valuation is in fact a common procedure in private and public decision making. When consumption decisions are made, or when a new airport is built, a forest protection area is established, a damaged watershed is rehabilitated consequences on environmental goods are either implicitly or explicitly taken into account in relation to the outcomes of the decisions. Very often, however, such valuation processes are not documented and lack explicit accountability. This is not entirely the fault of those who are in charge of these decisions. Environmental commodities have characteristics that make it difficult to gauge their values. More specifically, they are often characterized by two properties. Their first property is non-excludability in consumption, which means that it is impossible or very expensive to exclude an individual from attaining benefits from environmental amenities. For example, one cannot prohibit individuals from breathing clean air or enjoying the beautiful scenery of agricultural lands in a rural area. It is thus impossible to exclude anyone from the consumption of such a good. Another property which is also given for many environmental goods is their non-rivalry in consumption. This means that environmental goods can be utilized by more than one person without decreasing the benefits to be received by other users. Because of their public good nature, property rights for environmental goods cannot be clearly defined. So, there is no market where prices for environmental commodities are traded in light of their supply and demand. This absence of a market price, as explained in the introductory chapter, makes it impossible for us to realize the value of the environment through readily available market data. So, the value of environmental goods has to be quantified by other means, i.e. by the use of environmental valuation techniques.

Environmental valuation methods can be used for several purposes (Hanley et al. 2001a). Their first important field of application is the provision of quantitative input for cost-benefit analysis (CBA) (Hanley 2001; Hanley and Barbier 2009). CBA is a very important decision tool when it comes to decisions on the allocation of public funds in environmental sector. As a decision guideline, public decision-makers conduct a CBA, where the benefits of a project under consideration are compared to its costs. A proposed environmental project should be undertaken only if the project costs are outweighed by the benefits the project creates for society. While the calculation of project costs is rather straightforward – as all costs (e.g. material, labor, land, and capital costs) usually have market prices determined in the competitive marketplace – the

assessment of the project benefits is often much more problematic. This is because the public good nature of environmental goods. No market prices exist for benefits resulting from environmental project. Here, environmental valuation must be applied to appraise the benefits of the project in monetary terms, which then can be directly compared to the project costs. Information obtained from environmental valuation will enable policy-makers to efficiently allocate limited public funds.

The second use of environmental valuation is for the assessment of environmental damage. This use of environmental valuation is particularly important in the USA where under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), states and the federal government are able to hold parties accountable for their releases of hazardous substances that may endanger environmental goods. Because of the public good nature of the environment, no market prices exist for quantifying the monetary value of environmental damage. So, environmental valuation techniques have to be employed in order to assess the value of such damage.

The third use of environmental valuation data is for the adjustment of national accounting figures such as gross domestic product (GDP) to take into account the state of the natural environment. In its classic form, GDP is an indicator of economic performance, providing an account of all the goods and services that an economy produces in a year. This conventional from of GDP, however, assesses only the gross output of an economy. Neither the deterioration of environmental quality nor the depletion of natural resources that are associated with the output of respective economy is taken into account. In order to provide a complete description of the state and the development of an economy, the traditional GDP has to be adjusted by incorporating the changes in the natural capital. Again, as such environmental changes are unpriced by the market, environmental valuation have to be employed. After the importance of environmental valuation is introduced in this section, the next section presents the many different channels through which the environment can generate value to individuals and societies. For this purpose, the conceptual framework of the total economic value of the environment will be presented.

2.1.2 Total economic value of the environment

In the sphere of economic theory, the notion of value is anthropocentric. Environmental commodities are considered as carrying values only if they are beneficial to humans, i.e. only if they generate utility to individuals (Tietenberg and Lewis 2009). This notion of value excludes other types of value that are not related to humans such as intrinsic or ecological value, concepts

which acknowledge that the natural environment has its own value regardless of whether or not any human derives utility from it (Naess 1986). This anthropocentric view of value forms the basis for the framework of the total economic value of the environment to be discussed below.

According to the framework of total economic value, the natural environment generates a wide range of values to society. These can be grouped into two major categories, use and non-use values (Figure 2-1). Use value, to begin with, is the economic value generated through the physical use of environmental goods. The environment can be used both as production factor and consumption good. As production factor, the environment supports the economy as source of energy (e.g. natural gas, coal, petroleum, wind, and sunlight) and raw materials (e.g. timber, minerals, fish, and water). As consumption good, it provides basic necessities sustaining human life like food supply, clothing, medicine, and water. Further, the natural environment is an important source of recreational opportunities. People enjoy snorkeling in a crystal-clear ocean, trekking in a gigantic cave, or savoring the sunset on a beautiful beach. These activities generate so-called direct use values of the environment. Other than the direct use value, the environment also provides services to society like, e.g. carbon sequestration or as waste sinks. Individuals consume these services only in an indirect way because they feed into or support the production of goods which are then directly consumed by humans. Traditionally, these services are classified as generating indirect use values separating them from goods producing direct use benefits discussed above.

Figure 2-1: Total economic value of the natural environment

Total Economic Value

Use Values	Non-Use values
Direct use value	Bequest value
Indirect use value	Existence value
	Option value
	Quasi-option value
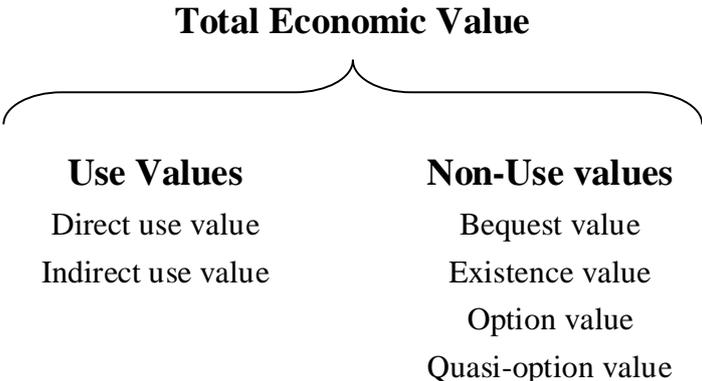
There is a problem from expressing the economic value of the environment via its use values. People do not, and cannot, use *all* environmental goods every day, e.g. they cannot go diving or

hiking every day. Many people may have even never done it at all and only read about it in the magazines. That does not mean that coral reefs or beautiful valleys have no value for those people, but the value is generated by the fact that such environmental assets are available for use rather than being used on a constant basis. To make this point clearer think about a hospital. Many people rarely visit hospitals or none at all. Yet the hospital provide a valuable stand-by service for society. Its value cannot be fully expressed by the number of its users or income collected (Weisbrod 1964) but additionally by the option that people have to use it. This leads to the first type of non-use value to be introduced in this section, i.e. option value (Weisbrod 1964). It is the environmental value associated with the possible use of the natural environment in the future. A natural resource carries an option value when there is a positive possibility that it will have value for human society in the future. In this case, one would be willing to do something to preserve the option that the resource might prove valuable in the future.

The second type of non-use value is quasi-option value (Arrow and Fisher 1974). The quasi-option value accrues from the same motivation as option value. However, unlike the option value, the ability to utilize environmental goods is still uncertain. Environmental goods also produce welfare to individuals even though they may not expect to use them at all. This refers to bequest value of the environment. People may preserve the natural environment because they want to keep options open for the future generations to benefit from it. The last non-use value is existence value (Krutilla 1967): individual utility is obtained merely by acknowledging that particular environmental goods exist. It has been argued that existence value covers some areas of the ecologists' intrinsic value (Attfield 1998). This is because existence value implies that people value natural resources for their own sake. After introducing the total economic value of environment goods, the discussion can now turn its focus on the theoretical framework underpinning environmental valuation.

2.1.3 Environmental valuation in neoclassical economics

Based on a review by Ahlheim (1998), this section introduces the theoretical welfare measures that form the theoretical basis for major environmental valuation techniques. To facilitate the illustration, let us assume a society with $h = 1,2,\ldots,H$ households. Each household consumes N different market goods denoted by the vector $x_h = [x_{h1}, x_{h2}, \ldots, x_{hN}]$. Other than the consumption of the vector of market goods, households are provided with an environmental state z. In addition, I_h denotes household h's disposable income.

Now consider a public project which aims at improving some aspect of environmental quality. This project could be for instance a wetland rehabilitation program or a reforestation project. Of main interest is the net impact of the environmental project upon the well-being of society. Therefore, the welfare measures that are used to determine changes in the well-being of society are introduced. This will be done from the ground up so that the fundamentals of the measure are clear to the reader. As a starting point, let $w(\cdot)$ be a function known as the social welfare function that consists of the utility of all households living in the same society. In a democratic society, it should hold that:

$$W = w(U_1, U_2, \ldots, U_H), \qquad \frac{\partial w}{\partial U_h} \geq 0, \tag{2-1}$$

where U_h represents the utility of household h ($h = 1, 2, \ldots H$). By $\frac{\partial w}{\partial U_h} \geq 0$ it is meant that no single household in this society is to be discriminated against. It ensures that for all social decisions the welfare of any household must not be decreased. Now consider the environmental project. Two particular states of the project are of interest. Let $i = 0$ represent the initial state, i.e. the situation before the implementation of the project, and let $i = 1$ denote the new situation, i.e. the state after the project has already been implemented. The environmental program is intended to improve the state of the environment z^i from an initial situation z^0 to a final situation z^1 which are both an argument of any household's utility function. This would result in a change of social welfare and can be expressed as:

$$\Delta W^{01} = w^{01}(\Delta U_1, \Delta U_2, \ldots, \Delta U_H). \tag{2-2}$$

In equation (2-2), ΔW^{01} expresses the social welfare change between situations 0 and 1 while ΔU_h represents the utility change of individual household h between those two situations. From equation (2-2) the measure of the change of social welfare resulting from an environmental project can be decomposed into two main steps. The first step, also known as the assessment problem, is to identify the welfare change of each single household ΔU_h for all households being affected by that environmental change. The second step, the aggregation problem, is to aggregate these utility changes of all households to obtain the social welfare change. It will first be explained how welfare changes of individual households can be measured followed by a discussion of the aggregation of the welfare of individual households.

In order to identify the welfare change of an individual household, a welfare measure is needed that is able to indicate whether that household is better off, worse off, or as well off as before the environmental project was implemented. For this, a welfare measure IND^{01} has to fulfill what is known as the indicator criterion which reads:

$$IND^{01} \underset{<}{\overset{>}{=}} 0 \quad \Leftrightarrow \quad U_h^1 \underset{<}{\overset{>}{=}} U_h^0 \quad (h = 1, 2, \dots, H). \tag{2-3}$$

Now, it is still possible that welfare measures that fulfill the indicator criterion may not be empirically observable. In welfare theory, such an indicator may refer to the mathematical functions that represent the unobservable preference orderings of consumers (and thus fulfill the indicator criterion) but cannot be computed empirically. Due to this reason, the welfare indicator that is needed must be computable on the basis of empirically observable data. This criterion, i.e. the computability criterion, can in fact be regarded as a prerequisite for the practical implementation of any welfare measure. The construction of welfare measures typically begins with a mathematical function that can describe the preference ordering of an individual household. This is because by definition the measurement of welfare aims at the preferences of an individual. Of all mathematical functions to describe a preference ordering, the most well-known is the direct utility function:

$$U_h = u_h(x_h, z^i) \quad (h = 1, 2, \dots, H). \tag{2-4}$$

The direct utility function of a household is a function of x_h, the consumption bundle chosen by household h, and z^i, the states of the environment. Note that z^i are predefined on a societal level and cannot be chosen by the household. Thus, it is not household-specific and subscripted with h. Both an increase of consumption of market goods and an improvement of the state of the environment z^i increase household utility, i.e. $\frac{\partial u_h}{\partial x_h} > 0$ and $\frac{\partial u_h}{\partial z^i} > 0$. This means that all arguments can be considered as goods. Now let us consider the impact of the environmental project. The difference between household utility before and after the implementation of the project can be described as:

$$\Delta U_h^{01} = U_h^1 - U_h^0 = u_h(x_h^1, z^1) - u_h(x_h^0, z^0) \tag{2-5}$$

Typically, an environmental project does not induce only the effect on the states of the environment z^i (the environmental effect) but it also triggers the market good effect. The market good effect refers to the project's consequences on household income and market prices. The environmental project typically has direct effects on household income. It generally decreases household income because the implementation of the project usually requires government to raise additional taxes. Such an effect is captured by I_h^i. Let I_h^0 ($h = 1,2, \dots H$) denote the income of household h in the initial situation, while I_h^1 refers to household income in the final situation. The project also influences market prices $p = [p_1, p_2, \dots, p_N]$ for the N market goods consumed by a respective household h because some market commodities are consumed more after the environment is improved (e.g. fishing and camping equipment after a formerly eutrophicated lake has been cleaned) while some are consumed less (e.g. video game consoles in this case). These changes in consumption are presumed to affect market prices. These effects are described by p^i. Let p^0 refer to the vector of market prices in the initial situation, while p^1 refers to the vector of market prices in the final situation. Observe that all households encounter the same prices in the market so the subscript h does not appear with p.

Since income and market prices are also affected by an environmental improvement project, it is more straightforward to use the indirect utility function v_h which can be obtained by maximizing the utility of household h with respect to its budget constraint $I_h = p.x_h$. Substituting the direct utility function by the indirect one yields:

$$\Delta U_h^{01} = v_h(p^1, I_h^1, z^1) - v_h(p^0, I_h^0, z^0), \tag{2-6}$$

where $v_h(\mathrm{p}^1, I_h^1, z^1)$ denotes the maximum utility household h can obtain from consuming the optimal consumption bundle x_h^1, given market prices p^1, income I_h^1, and environmental state z^1. Similarly, $v_h(p^0, I_h^0, z^0)$ refers to the maximum utility household h can obtain from consuming the optimal consumption bundle x_h^0, given market prices p^0 and income I_h^0 in the environmental state z^0. When it comes to the assessment of utility difference as expressed in (2-5) and (2-6), both expressions are not useful as neither direct utility function nor indirect utility function is observable. In order to derive a welfare measure that satisfies both the indicator and computability conditions, another form of expressing a preference ordering has to be employed, i.e. the expenditure function e_h. The expenditure function $e_h(p, z, U_h)$ refers to the minimum amount of money a household must spend at given prices p and environmental state z in order to attain the utility level U_h. An important property of the expenditure function is that it is strictly

increasing in U. That is, at a given level of market prices p and environmental state z, an increase in household utility must be accompanied by an increase in monetary expenditure. This is why this function is also called money-metric utility function. Given this strict relationship between household expenditures and household utility level, a household's utility can be measured in terms of the monetary expenditures.

Once equipped with the expenditure function, it is now possible to measure household welfare changes accruing from environmental projects. For this purpose, two prominent welfare measures developed by John Hicks (Hicks 1942), the equivalent variation (EV) and the compensating variation (CV), will be highlighted. The basic idea of these two measures is simple. The magnitude of a utility change of a household resulting from an environmental project can be indicated by the difference between the two levels of expenditure which are necessary for a household to obtain two levels of utility in the initial situation U^0 and final situation U^1. It is necessary to assess the levels of expenditure of the household to attain U^0 and U^1. However, as market prices p^i and environmental states z^i also vary between the two situations (before and after project implementation), one needs to fix both p^i and z^i at an arbitrary level. The two Hicksian welfare measures CV and EV are different only in terms of the states of the environment z^i and market prices p^i chosen as reference points for the expenditure function. Equivalent variation is defined with an initial state of the environment z^0 and an initial state of market prices p^0 as reference points, and can be expressed as:

$$EV_h^{01} = e_h(p^0, z^0, U_h^1) - e_h(p^0, z^0, U_h^0)$$

$$= e_h(p^0, z^0, U_h^1) - I_h^0. \tag{2-7}$$

The basic idea behind EV can be seen clearly from equation (2-7). EV is just the difference between: 1) the expenditure level that would be necessary for a household to obtain its final utility level (after implementation of the project) before prices and the state of the environment change (i.e. $e_h(p^0, z^0, U_h^1)$); and 2) the level of expenditure that would be necessary for that household to obtain the initial utility level (before implementation of the project), given the initial level of prices and state of the environment (i.e. $e_h(p^0, z^0, U_h^0)$). Since it is assumed that there is no private saving, the expenditure level in the initial state is equal to the initial level of income I_h^0. When the environmental project increases household utility, i.e. $U^1 > U^0$, EV can be interpreted as the minimum amount of money that should be given to a household to forgo the benefit (utility increase) it will receive if the project is implemented. This amount of money

is known as "willingness to accept" (WTA). On the other hand, if a project causes negative effects on household utility ($U^1 < U^0$), EV will be equal to the maximum amount of money that a household is willing to give up to prevent this project. This EV is referred to as "willingness to pay" (WTP). In simpler terms, this is the amount of money that can be extracted from the household so that it feels equivalently worse off as if the project had been implemented.

While the concept of EV is based on the initial state of market prices p^0 and environment z^0, CV employs the final state of market prices p^1 and environment z^1 as reference points, and can be expressed as:

$$CV_h^{01} = e_h(p^1, z^1, U_h^1) - e_h(p^1, z^1, U_h^0)$$

$$= I_h^1 - e_h(p^1, z^1, U_h^0). \tag{2-8}$$

From equation (2-8) it can be seen that CV measures the utility change by the difference between the new household income I_h^1 and the hypothetical income that would be necessary to keep the household at its initial utility level after prices and environmental quality have changed (Ahlheim 2002). When a public project increases a household's utility (i.e. $U^1 > U^0$), CV is equal to the amount of money that can be subtracted from the household and leave it as well off as before the implementation of the project. When a public project has negative effects on a household's utility (i.e. $U^1 < U^0$), CV can be interpreted as the minimum amount of money that a household will accept as compensation for its loss of utility and still feel as good as it felt before the project was implemented. On the one hand, CV – as the minimum amount of money to compensate for utility loss of a household – is interpreted as WTA. On the other hand, CV – as the maximum amount of money that can be taken away from a household and still leave it as well off as before the project – is referred to as WTP.

In practice, CV is preferred to EV. This is because the interpretation of CV as WTP for a utility improving environmental change and as WTA compensation for a utility decreasing environmental change is more intuitive than the respective interpretations of the EV. In addition, it might be easier to convey the basic idea of CV to the respondents of environmental valuation surveys. That is, it might be more meaningful to ask respondents how much they are willing to pay for an increase of utility (CV) instead of the prevention of a utility decrease (EV). It is also more intuitive to ask respondents to accept compensation for their utility loss (CV of a utility loss) than to ask about their willingness to forgo the benefit they would receive (EV of a utility increase). The following consideration, therefore, will be limited to the compensating variation.

The term CV_h^{01} as specified in (2-8) cannot be empirically assessed. This is because one cannot observe the term $e_h(p^1, z^1, U_h^0)$, which represents the hypothetical expenditure necessary for the household to keep its initial level of utility when prices and the environmental state have already changed. In order to assess it empirically, the CV_h^{01} has to be reformulated by adding additional terms (that sum up to zero), as follows:

$$CV_h^{01} = \quad e_h(p^1, z^1, U_h^1) - e_h(p^0, z^0, U_h^0) +$$

$$e_h(p^0, z^0, U_h^0) - e_h(p^1, z^0, U_h^0) +$$

$$e_h(p^1, z^0, U_h^0) - e_h(p^1, z^1, U_h^0). \tag{2-9}$$

From (2-9), different components of the Hicksian compensating variation CV_h^{01} become clear. The difference in the first row of (2-9) represents the compensating variation that is induced by the change in household income and can be denoted with CVI_h^{01}. The difference in the second row of (2-9) equals the compensating variation resulting from the changes of market prices, so an alternative expression is CVP_h^{01}. The difference in the last row of (2-9) is the change in the household's utility resulting from the change of environmental quality and can be denoted with CVZ_h^{01}. As a result, the total compensating variation CV_h^{01} can be represented by the sum of three partial compensating variations according to

$$CV_h^{01} = \quad CVI_h^{01} + CVP_h^{01} + CVZ_h^{01}. \tag{2-10}$$

The separation of the total compensating variation CV_h^{01} into the three partial compensating variations is very useful as there exist computation techniques for the empirical assessment of each of the three partial compensating variations. The expression CVI_h^{01}, for a start, can be calculated by finding the differences between the initial level of household income (before implementation of the project) and the final level of household income (after implementation of the project) for all households in society. This can be expressed as:

$$CVI_h^{01} = \quad e_h(p^1, z^1, U_h^1) - e_h(p^0, z^0, U_h^0) = I_h^1 - I_h^0 = \Delta I_h^{01}. \tag{2-11}$$

The expression CVP_h^{01} can be written in an alternative form. According to the Fundamental Theorem of the Differential and Integral Calculus:

$$CVP_h^{01} = e_h(p^0, z^0, U_h^0) - e_h(p^1, z^0, U_h^0) = -\int_{p^0}^{p^1} \nabla_p e_h(p, z^0, U_h^0)\, dp. \qquad (2\text{-}12)$$

According to Shephard's Lemma, equation (2-12) then reads:

$$CVP_h^{01} = -\int_{p^0}^{p^1} \xi_h(p, z^0, U_h^0)\, dp, \qquad (2\text{-}13)$$

or the integral over the vector of Hicksian demand functions between the initial and final levels of market prices. Though the Hicksian demand functions are not observable, they can be computed via information obtained from the Marshallian demand function (Vartia 1983). The expression CVP_h^{01} can therefore be empirically assessed.

The only remaining challenge is the empirical assessment of CVZ_h^{01}. This expression can also be written in an alternative form. According to the Fundamental Theorem of the Differential and Integral Calculus:

$$CVZ_h^{01} = e_h(p^1, z^0, U_h^0) - e_h(p^1, z^1, U_h^0) = -\int_{z^0}^{z^1} \nabla_z e_h(p^1, z, U_h^0)\, dz. \qquad (2\text{-}14)$$

According to Shephard's Lemma, equation (2-14) then reads:

$$CVZ_h^{01} = \int_{z^0}^{z^1} \pi_h(p^1, z, U_h^0)\, dz = WTPZ_h^{01}, \qquad (2\text{-}15)$$

where π is the vector of shadow prices of environmental quality. These shadow prices are equal to the marginal expenditure for a unit of consumption of environmental quality $\frac{\partial e_h}{\partial z}$. But since the shadow prices of environmental quality cannot be observed an alternative method is needed to reveal the actual benefit of the change in environmental quality. In practice, household utility generated by an environmental project expressed as CVZ_h^{01} can be elicited by different environmental valuation methods, all of which aim to elicit the WTP of the households for the change in environmental quality ($WTPZ_h^{01}$). Such a valuation forms part of the total welfare change of household h from a public environmental project which consists of the utility changes resulting from a change in income, a change in prices and a change in environmental quality and can now be expressed by equation (2-16):

$$CV_h^{01} = \Delta I_h^{01} + \int_{p^1}^{p^0} \xi_h(p, z^0, U_h^0) dp + WTPZ_h^{01}. \qquad (2\text{-}16)$$

It is now possible to identify whether the environmental project in question makes the individual household better off, worse off, or as well off as it was at the initial situation (i.e. whether the outcome of equation (2-16) is greater than, smaller than, or equal to 0).

After assessing the individual welfare changes for all households affected by an environmental project (the identification problem), the problem of aggregating these individual welfare changes into an indicator of the change in social welfare have to be addressed (the aggregation problem). The solution to this aggregation problem is straightforward if all households in society are better off or worse off as a result of the project in question. It is clear that the project should be undertaken or called off, respectively. In these unambiguous cases, the social decision can be derived directly from the information of individual welfare changes. Unfortunately, projects which can generate unambiguous welfare changes are very rare. Most environmental investment projects create both winners and losers. One group of people is usually made better off at the cost of others. For these ambiguous cases, measures for changes in social welfare resulting from environmental projects must be identified.

From Arrow's Impossibility Theorem (Arrow 1963) it is known that under reasonable conditions there exists no possible way to objectively and uniquely aggregate individual preferences. The aggregation of individual preferences will lead, one way or another, to the distributional judgment of welfare (i.e. how welfare should be weighted among different groups of people), which is strictly prohibited in ordinal utility theory. However, this strict requirement is usually relaxed for practical purposes. Practical CBA conventionally employs Hicks-Kaldor criterion, also known as potential Pareto criterion (Hicks 1939; Kaldor 1939). The Hicks-Kaldor criterion holds that if the losers (i.e. people who are made worse off) from a certain project can be compensated by the winners (i.e. people who are made better off through the project), and the winners would still be better off, the project could be considered to increase social welfare. According to the Hicks-Kaldor criterion, an indicator of social welfare change can be computed by adding up the individual compensating variation across all households affected by the project as:

$$\sum_{h=1}^{H} CV_h^{01} = \sum_{h=1}^{H} \Delta I_h^{01} + \sum_{h=1}^{H} \int_{p^1}^{p^0} \xi_h(p, z^0, U_h^0)dp + \sum_{h=1}^{H} WTPZ_h^{01} \qquad (2\text{-}17)$$

$$\sum_{h=1}^{H} CV_h^{01} \begin{array}{c} > \\ = \\ < \end{array} 0 \quad \Rightarrow \quad \Delta W^{01} \begin{array}{c} > \\ = \\ < \end{array} 0 \qquad (2\text{-}18)$$

where ΔW^{01} denotes the change of social welfare between situations 0 and 1. A strictly negative balance of the aggregate CV is an indicator of a decrease in social welfare resulting from the environmental project. A strictly positive balance of the aggregate CV indicates an increase in social welfare resulting from the project. The positive balance of the overall CV also implies that winners from the project are able to compensate losers for their welfare loss and at least one winner would still be better off than before the project is implemented. However, such compensations are never made in reality. This means that the Kaldor-Hicks criterion implies interpersonal welfare comparisons, a step that is strictly prohibited in the realm of ordinal utility theory. It is important to keep in mind that this aggregation exercise implies the use of arbitrary political value judgments.

To calculate the Hicksian compensating variation for the whole society, it is necessary to identify, for all households, income changes, and welfare changes from price changes and environmental changes (see 2-17). These tasks are time and cost intensive and they make the valuation of small environmental projects often not feasible. Therefore, a simplified version of the appraisal method has to be found. This simplified approach relies on a comparison between the aggregated individual benefits from the planned environmental project and the overall costs of the project.

$$BC^{01} = \sum_{h=1}^{H} WTPZ_h^{01} - p^1 q \qquad (2\text{-}19)$$

where $p^1 q$ is simply the cost of the environmental project in question, p^1 is the price vector of all factor inputs q that are involved in the implementation of the environmental project. The total cost of the project, $p^1 q$, is compared to the benefit of the project, $\sum_{h=1}^{H} WTPZ_h^{01}$. The term, $\sum_{h=1}^{H} WTPZ_h^{01}$ refers to the aggregate WTP of all households in society for the implementation of the environmental project in question. Notice that in this simplified approach of the practical CBA, the measurement of benefits focuses exclusively on the welfare change induced by the

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change in environmental quality. The usual rule is that when a project's benefit as measured by $\sum_{h=1}^{H} WTPZ_h^{01}$ exceeds its cost, the project in question should be carried out; otherwise the project should be abandoned, since it does not produce net welfare to society. In the next section, a variety of environmental valuation techniques that have been developed to assess individual WTP for environmental changes in the real world will be introduced and then discussed in detail.

2.2 Environmental valuation: Practice

In general, environmental valuation techniques have been categorized into two main categories: indirect and direct methods. Indirect valuation techniques utilize information on the actual consumption of market goods to draw conclusions about a household's preference for non-market environmental goods. This category consists of the averting behavior method (ABM), the travel cost method (TCM), and the hedonic pricing method (HDM). As these indirect methods reveal people's preferences for non-market environmental goods through their consumption of market goods, they are also called revealed preference methods. The direct valuation methods include the contingent valuation method (CVM), attribute-based choice modeling (ABCM), and the participatory valuation method (PVM). An essential component of these techniques is that they directly ask respondents about their preferences for environmental public goods. They utilize hypothetical market settings in which households have an opportunity to state their preference for environmental goods. This is why these methods are also called stated preference methods. In this section the indirect and direct methods will be introduced in turn. Since this study will focus on the CVM as a model for the direct valuation approach, CVM will be discussed in more detail.

2.2.1 Indirect methods

The indirect valuation or the revealed preference methods aim at the assessment of the use value of environmental commodities using information revealed in the market, i.e. the households' consumption of related market goods. An important assumption underpinning indirect methods is the weak complementarity. Introduced by Mäler (1974), the concept of weak complementarity has been widely used in the valuation of non-market goods based on observable market behavior (Palmquist 2004). In short, the concept requires that there be a market good[1] that is consumed with the environmental good considered. For the weak complementarity to hold, it is assumed

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[1]As it is often impossible to single out an obvious private good that is a weak complement to the environmental good, Bockstael and Kling (1988) investigate the weak complementarity between the environmental good with sets of market goods.

that the market good is non-essential or that there is a choke price at or above which the consumption of the good falls to zero. Above the choke price, the changes in environmental quality play no role in consumers' well-being, i.e. the marginal utility of the environmental good under consideration is zero. If the necessary kit for scuba diving becomes so expensive that nobody dives, the marginal benefit of an increase in the quality of the coral reef is also zero. One implication of the weak complementarity is that the benefits from the environmental amenities can be approximately measured from the demand equation from its complementary market good. Another important, though implicit, assumption underlying indirect methods is that the representative households are assumed to have utility functions that are weakly separable (Hanley and Spash 1993). This means that the demand curve for environmental quality under consideration can be estimated while ignoring prices of all other goods. Going back to the scuba diving example, the demand for scuba diving can be estimated independently of demand for alternative goods, e.g. hiking (alternative leisure activity), or for rice (alternative non-leisure consumption). In the following, the most frequently used revealed preference methods are introduced.

Averting Behavior Method (ABM)

The idea underlying the ABM is the household production function theory of consumer behavior (Abdalla et al. 1992). The name may seem odd at first sight. However this theory only states that a household acquires consumption goods using various inputs. These input variables include capital, labor, as well as other consumption goods and environmental qualities. To illustrate, households may combine three inputs, say, the ground water in their properties, their manpower, and the water treatment equipment to produce a new commodity, for example drinking water. Some of these inputs (e.g. ground water) may be subject to degradation (e.g. via pollution caused by a manufacturer in the vicinity area). This triggers households to adjust their consumption levels of other input goods (e.g. upgrading their water treatment facilities). Following this reasoning, a change in environmental quality can then be appraised via changes in expenditures for the consumption goods needed to compensate for the change in environmental quality. Consider the effects of noise produced by an airport or highways as another example. Affected households have to increase their expenses for necessary counter-measures to cope with the noise problem, i.e. they might have to install sound-proof windows and air conditioners. In this sense, averting expenditures can be taken as an approximate of WTP for changes of environmental quality. The social benefits of a public policy or project aiming at the reduction

of noise can be estimated from the households' averting expenditures that could be avoided when the original source of pollution or noise is reduced.

Of course, for the averting expenditure to reflect the exact welfare effect on households from the environmental changes, it must be a perfect substitute of environmental quality. But this is rarely the case. Very often, households are not able to avert all the detrimental effects from environmental degradations. Environmental changes might intrude individual utility without any averting measures possible. Households are not able, for instance, to use the sound-proof windows they purchase to eliminate the noise they experience in their backyards. In this case, the averting expenditure will give an underestimation of the use value households would receive from the reduction of noise. On the other side, it is also possible that the counter-measures can be jointly consumed for other purposes. Sound-proof windows may not only reduce the noise from the nearby airport but also save electricity bills by preventing heat losses. Here, the expenditure for double-glazed windows gives an overestimate of the benefits from a potential noise reduction program. Despite these shortcomings, the ABM is still favored by some researchers due to its simplicity. Valuation studies applying the ABM usually revolve around limited topics, such as air pollution, and pest control (Abrahams et al. 2000; Wu and Huang 2001).

Travel Cost Method (TCM)

One of the first methods developed to estimate the demand for environmental amenities is the TCM. The method was initiated in the context of the planning and management of outdoor recreation (Wood and Trice 1958; Clawson and Knetsch 1966). The TCM assumes that traveling to experience a recreational site is costly, and that the travel costs incurred by individuals can be taken as an indicator of the benefits they will gain from enjoying the site. The types of travel costs in the TCM usually include costs for transportation like gasoline and train or bus tickets. It also takes into account other out-of-pocket expenses that are necessary to enjoy environmental amenities, e.g. entry fees, on-site expenditures and equipment like fishing boats, lifejackets, or swimming suits. As the travel costs increase with distance, it is usually observed that the visitation rate diminishes at greater distances from the site. In principle, treating the differential costs as prices means that the demand curve for recreational visits can be derived. The resulting area under the demand curve gives an estimate of the total consumer surplus accruing to visitors to the recreational site (Hanley and Spash 1993). The TCM has been applied to assess social

welfare generated by a wide range of recreational sites, e.g. coral reefs, islands, forests, and national parks (Shrestha et al. 2002; Bhat 2003; Chen et al. 2004; Ahmed et al. 2007).

However, the TCM suffers from a number of theoretical and practical shortcomings. With regard to its theoretical basis, Ahlheim and Frör (2003) point out that since the demand functions estimated by the TCM are of the Marshallian type (i.e. the demand derived from observation in the competitive market), their integration generates all the problems known from the discussion of the Marshallian consumer surplus (e.g. path-dependency of the integral). This does not lead to CV because Hicksian demand functions would then be needed. Another shortcoming of the TCM regards the calculation of travel cost. Equipment purchased for the purpose of enjoying environmental goods is durable and can be utilized for other purposes, as well. This problem is similar to that mentioned in the ABM. Hiking boots can of course be used for more than one trip. The allocation of its cost to one single trip is disputable (Randall 1994). The same applies to multi-purpose trips. Travelers usually visit several places in one single trip. They may also use the opportunity of the trip to visit their relatives or old friends in the area. In this case, specifying costs for one particular site incurred by a household is problematic. Neglecting these problems altogether will lead to an overestimation of the travel cost necessary to enjoy a certain recreational site and thus the individual welfare that households obtain from this site. The second difficulty relates to the valuation of time. Apart from out-of-pocket expenses, the TCM usually includes the value of time in the calculation of the travel cost. It is unclear, however, which part of the time should be counted as travelling costs. The opportunity cost of time is also far from obvious. A fraction of personal wage is often used as a value of time (Fix and Loomis 1998; Liston-Heyes and Heyes 1999). But this can be problematic as an individual usually spends his or her holiday for travelling.

Hedonic Pricing Method (HPM)

The last revealed preference method to be discussed is the Hedonic Pricing Method (HPM). What distinguishes the HPM from other indirect valuation techniques is its basic premise: that a commodity possesses various characteristics, and it is these characteristics that give rise to individual utility. It can then be derived that people place value on a commodity according to its attributes, and that price of a commodity should reflect its attributes (Lancaster 1966). According to this assumption, the price p of a commodity is the function of its various characteristics $x_1, x_2, \ldots, x_n$ and can be expressed as:

$$p = f(x_1, x_2, \ldots, x_n). \tag{2-20}$$

Consider the real-estate market as an example. The price of an apartment is determined by its general attributes, such as total area, number of bedrooms, quality of construction materials, basic infrastructure, etc. To apply the HPM to environmental valuation, it is further assumed that at least one of the n characteristics of the commodity is related to an environmental quality. The price of the apartment, for instance, also reflects characteristics related to environmental qualities, such as air quality in the area or a possible lake view. By means of the HPM, the value of these environmental quality aspects can be estimated.

In general, there are two steps of the HPM technique (Hanley and Spash 1993). The first step involves an estimation of the relationship between the environmental characteristic x_i and the price of the related market good, i.e. the function $f(.)$ in (2-20). The partial derivative of the price with respect to the environmental characteristic $\frac{\partial p}{\partial x_i}$ is equal to the marginal cost of buying one additional unit of that characteristic and, if the real-estate market functions perfectly, the marginal benefit of a one unit increase in that characteristic. The second step of the HPM is to estimate a demand curve for the environmental quality in question using the information gained from step one. The calculation procedure, however, depends critically on the assumptions about the supply side of the real-estate market.

A number of drawbacks of the HPM must be mentioned. First, the HPM assumes that the market under consideration is in equilibrium, i.e. all buyers have perfect information and they can move to the utility-maximizing position. This is rarely the case in reality. Estate agents have considerable incentives to exaggerate the positive aspects of an apartment, often including associated environmental quality aspects. They also have incentives to play down the negative aspects. The choice that buyers make based on this information may not be consistent with what they would have chosen if they had had the complete set of information. The consequence is that HPM estimates may not represent the value an individual actually places on a particular environmental good. A similar problem also arises if there is a limited variety of apartments in the real-estate market. As a consequence of this limited supply the observed prices may not equal market prices that would have evolved in equilibrium. Second, the HPM elicits social benefits generated from the environment at its present level of quality. However, some buyers may know in advance about possible future changes of environmental quality and complete a market transaction based on their expectations of future changes. The implicit prices of environmental quality derived from the present prices of real estate would be overestimated as

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a result (Hanley and Spash 1993). Third, it is usually the case that the number of combinations of characteristics of a good is limited. For example, only a limited number of different varieties of apartment is available in the real-estate market. Individuals cannot freely configure their preferred characteristics of the apartment. Consequently, the consumers may not be able to completely express their preference.

All of the indirect valuation techniques reviewed in this section offer two common advantages. First, they deal with the actual consumption and production behavior in a competitive market. It is well-known that actual market behavior is the most reliable source of information on individual preferences. Second, in these valuation techniques, participants are tasked with simple questions (if individuals have to be directly asked at all). They are not overloaded with cognitive tasks but merely asked about their daily activities (e.g. their counter-measures against air pollution). In spite of these advantages, the application of the revealed preference methods is rather limited. As indirect valuation methods rely on actual market behavior, such methods cannot be used to value projects that will lead to the future change of environmental quality. Another, perhaps more important, disadvantage of these methods is that the market-related data obtained in the framework of these techniques can only capture the use values of the natural environment. These techniques cannot capture non-use values (e.g. existence value, quasi-option value, or bequest value) since non-use values have no behavioral trail for economists to follow (Krutilla 1967). The discussion of shortcomings of the valuation techniques reviewed in this section paves the way to the next section, in which the direct valuation methods are reviewed.

2.2.2 Direct methods

The direct valuation methods rely on statements made by households regarding the welfare they expect from the implementation of a particular environmental project. The core element of all of these methods is the survey in which non-market environmental goods are described in detail. Thereafter, a framework is introduced to respondents in which they are asked to express their appreciation for the environmental goods provided by that project in terms of their WTP or WTA. Since all aspects of the goods can be presented including their use- and non-use aspects, respondents are expected to realize the total economic value these environmental goods. Thus, household responses are assumed to capture the whole range of environmental values, both use and non-use values. It is also possible to use direct valuation methods to appraise the social benefits expected from an environmental project that is not yet implemented and thus assess

future expected benefits. In this section, three methods classified in this methodological category are presented.

Contingent Valuation Method (CVM)

The CVM is by far the most prominent direct valuation technique. It relies on extensive surveys with a representative sample of the population likely to be affected by some environmental project. In a CVM interview, which can be conducted face-to-face, by mail, or by telephone, a detailed description of the project in question (project scenario) is presented to the respondent. Thereafter, the respondents encounters a hypothetical market setting in which they are given the opportunity to express their maximum WTP to support the environmental project proposed, or to go without it. The empirical WTP responses obtained from the respondents are taken to be a monetary expression of the utility level they expect from the planed environmental project. To calculate the social values of the project, the mean WTP is estimated from the sample of surveyed households and then multiplied by the total number of households living in the area affected by those environmental improvements. Although it is capable of assessing the total economic value of environmental goods, the CVM has attracted criticism regarding the reliability and validity of the WTP it produces (Desvousges et al. 1993; Diamond and Hausman 1993). As the CVM constitutes the main focus of this study, its procedures are discussed in more detail in section 2.3. The quality of the welfare estimates from the CVM is discussed in section 2.4. Before that, this section briefly introduces the participatory valuation method (PVM) and attribute-based choice modeling (ABCM).

Participatory Valuation Method (PVM)

It has been mentioned earlier in Chapter 1 that one methodological weakness of the CVM is that it requires a high cognitive effort from the respondent when being asked to state a WTP for an environmental good. Respondents have to form an exact idea regarding the benefits of the environmental amenity they may have never heard of before (in terms of its use- and non-use benefits). There is no place for them to try out how the benefits from the project feel like. In addition to that, CVM respondents have to complete all these tasks within a limited amount of time. In response to these limitations, participatory valuation methods (PVM) have been devised. To date, there are two main methods in this category: citizen juries (CJ) (Sagoff 1998; Kenyon and Nevin 2001) and the market stall approach (MS) (Macmillan et al. 2002; Álvarez-Farizo et al. 2007). Both the CJ and the MS approach make use of the idea of a micro-society in

which a number of participants are randomly selected to symbolically represent the entire society in a workshop setting; they then decide about issues regarding public goods. PVM meetings, as specified in the CJ and the MS approach, involve from 6 to 16 respondents who come together, form small groups, and discuss and deliberate about an environmental project over a number of days. During these meetings, participants are provided with extensive information about the proposed program, and are allowed to question experts and stakeholders and discuss evidence with other participants, thereby gradually increasing their understanding of the issue. In the CJ participants are grouped together and treated in a jury-like manner. The CJ does not necessarily aim to produce quantitative WTP estimates. Rather it expects qualitative information received from the preference construction process of participants, which can be closely monitored during the meeting, and also a consensus outcome which reflects the public interest. On the contrary, the primary intention of the MS approach is to produce WTP estimates using a participatory approach. The MS consists of groups of 6-10 respondents. The meetings are held two to three times, approximately one week apart from each other. Between meetings, respondents are given an opportunity to discuss the issues with their families, and jot down the results in a notebook provided. They can then talk about their feelings in the group meeting held the following week. The MS approach is expected to circumvent the CVM's problem of conveying the complexity of environmental goods the limited time of the survey interview, while also producing WTP estimates (Lienhoop and MacMillan 2007).

As with other valuation methods, the CJ and the MS have drawbacks. First, both are conducted with small groups of respondents. Hence, the sample size of a study applying either technique cannot be statistically representative of the whole population affected by an environmental project. The second shortcoming of these methods is that participants in the valuation workshops may be pressured by the group norm and therefore cannot express their true feelings. It is therefore the task of the moderator to ensure that no individual is allowed to overly take the floor to persuade other participants. However, the actions of the moderator should also be closely monitored, as this person plays an important role in leading the group discussion and eliciting conclusions from the group. The sensitivity of valuation outcomes to the role of the moderator might impair the validity of the results. The third drawback is that, as the CJ and the MS provide participants with more time regarding the discussed topic, this may allow participants to act strategically with regard to their WTP response rather than report truthfully. It can therefore be concluded that neither the CJ nor the MS are good substitutes for the conventional CVM. Nonetheless, they may be a perfect complement for CVM studies in

providing practitioners with qualitative data assisting the interpretation of quantitative results of a CVM survey.

Attribute-Based Choice Modeling (ABCM)

The basic premise of the ABCM is similar to that of the HPM: any particular consumption good is assumed to generate utility through its attributes. A waterfall for example, can be decomposed into its utility generating characteristics like water quality, water quantity, its scenery, wildlife habitat, and road access. The ABCM is devised in order to estimate the welfare effects that each of these environmental attributes produces for individuals. This marks the basic difference between the CVM and the ABCM. The ABCM is interested in assessing the values of different attributes of an environmental good whereas the CVM focuses on eliciting the value of an intact environmental asset described in one single scenario. In an ABCM survey, alternative versions of the same environmental good (each differing in one or several of its basic attributes) are presented to respondents. For instance, the respondents may have to consider different versions of the same waterfall one of which may have excellent water quality and fair road access while another has fair water quality but excellent access. An important characteristic of the ABCM is that one of the attributes of the good must be the price necessary for the provision of that good. Because price is included as one of the attributes of the goods, WTP for each attribute can then be calculated (Hanley et al. 2001b, p.436).

The ABCM refers to different valuation methods that employ the basic valuation approach described above. These techniques only differ in the way respondents are asked to express their choices over the variations of the good in question. These techniques include discrete choice experiments, contingent ranking, contingent rating and paired comparisons (Hanley et al. 2001b; List et al. 2006). Discrete choice experiments present to respondents variations of the same good each differing in the level of one or several characteristics. From the available alternatives, respondents are asked to select the most preferred one. This method is similar to the CVM in the sense that it asks respondents to choose between the proposed alternatives. In the CVM, respondents either pay for the project and enjoy environmental improvements or refuse to pay and remain at the status quo. For discrete choice experiments to produce theoretically consistent welfare estimates, a baseline alternative corresponding to the status quo must be presented in the choice set (Bateman et al. 2002, p.251). In a contingent raking survey, participants are required to rank a set of alternative versions of the good. Similarly, the welfare estimates produced from the contingent ranking are theoretically accurate only if a baseline situation

representing the status quo is presented to respondents. If such a no-change alternative is not offered, they might be forced to choose one alternative which they may not prefer at all (Bateman et al. 2002, p.252). The contingent rating method does not require respondents to make explicit comparisons between the alternatives. Instead it demands participants to rate each of the variations of the good on a semantic or a numerical scale. As no explicit trade-offs are made between the choices, the contingent rating method does not give welfare estimates that are consistent with utility theory. In a paired-comparison survey, respondents have to select the preferred alternatives of a set of two. They are also asked to indicate the strength of their preference on a semantic or numerical scale. The latter feature makes estimates from this method not consistent with economic theory, i.e. with ordinal utility theory. So, results of a paired comparison surveys cannot be applied in CBA.

Proponents of ABCM point out that the method is more informative than CVM studies, as respondents get multiple chances to express their preferences for valuing the good (Rizzi and Ortúzar 2003; Hall et al. 2004; Xu et al. 2006; Wang et al. 2007). They also argue that the ABCM minimizes the risk with respect to biases created by respondents since it does not directly ask survey participants for explicit WTP statements. WTP is estimated indirectly from respondents' choices stated in the survey. On a closer look, however, it can be seen that ABCM still suffer from two major shortcomings. First, it is clear that respondents in ABCM surveys are required to make tremendous cognitive efforts. It has been mentioned before that the cognitive burden for CVM respondents is high due to the hypothetical nature of the interview. This goes one step further in ABCM. Participants do not only face the difficulty of forming the exact idea about a project that might possibly still not yet exist, but they also have to consider more than two variations of the same project and also have to make the trade-offs between different attributes. Second, it is extremely difficult for researchers to design the choice set that constitutes of both credible and feasible levels of attributes of the good. Too far-fetched choice sets may induce survey participants to give unrealistic responses. A crucial point is to assign reasonable price levels that are coherent with the levels of attributes of the good (Bateman et al. 2002, p.261). Yet despite all these difficulties, ABCM offer promising valuation methods that incorporate advanced econometric techniques with the theory of rational and probabilistic choice. However, this set of methods also suffers from the complexity of its survey design which, at this point in time, seems inevitable.

2.3 The Contingent Valuation Method

The CVM is the most intuitive and simplest method to assess the welfare change that individuals expect from some environmental project. The method is intuitive because it asks respondents directly about their own expected welfare changes resulting from this project. It is simple because there is only one scenario and one trade-off decision involved. Due to its promising features, the CVM is chosen as environmental valuation method in this study. This section consists of two parts. The first part deals with details of the CVM interview and questionnaire design, the second part with the analysis of CVM data.

2.3.1 Survey administration and questionnaire design

CVM studies usually begin with the specification of the relevant populations. The aim here is to minimize potential biases arising from the choice of the population. There are two approaches to define the population of interest in a CVM survey (Carson and Hanemann 2005). The first approach is a political one. The survey may aim at the assessment of welfare of a specific group of people such as people who live in a certain political jurisdiction. So, defining the population according the political approach is rather straightforward.

The second approach to define the relevant population is an economic one. This approach incorporates all people who receive benefits and/or incur costs of the project considered. As a general guideline, three categories of population must be considered: the cost bearers, the user population, and the non-user population (Bateman et al. 2002). The identification of the cost bearers and the user population is relatively easy. The cost bearers are those who have to pay for the project if it is implemented. The user population contains people who obtain utility from the project by directly or indirectly using the resources it provides. The users of a project intending to clean up small canals in a city, for instance, would constitute citizens who dwell near the canals, those who commute via boats to their work places, people who jog along those canals, etc. The non-user population refers to those who hold non-use values for the project's outcomes. They are more difficult to determine as there is not necessarily a spatial link between an environmental project's outcome and those that hold non-use values for it. Strictly speaking, if the environmental good is extremely unique, the non-user population can be the national or even global population. However, while an environmental good may generate economic values for an individual living far away, such individuals may be few and far between. For practical purposes, some author has recommended the use of so-called distance-decay approach to estimate the distance beyond which economic value of an environmental good is approaching

some arbitrary small value (e.g. Hanley et al. 2003). This is under the assumption that as distance from an environmental good increases, the average values per household will decrease. Yet, the influence of distance decay on the values of an environmental good is not straightforward and depends on many factors such as the resource types (Hanley et al. 2003; Rolfe and Windle 2012) and the choice of welfare measure (Bateman et al. 2006).

After the identification of the relevant population, a representative sample of this population has to be selected. Ideally, all the citizens affected by the proposed project should be included in the survey. Nonetheless, due to the time and budget constraints, CVM researchers cannot interview the whole population. An alternative is to conduct interviews only with a group of sample households that can represent the whole population of interest. The representativeness of these households is very important. It ensures that the estimated mean WTP can be meaningfully extrapolated to obtain the social value of the project for the whole population affected. This means that non-probability sampling methods – such as convenience sampling, by which respondents are selected only because they are in the right place at the right time – are not appropriate for CVM surveys. Instead, various probability sampling methods (e.g. simple random sampling, or cluster sampling) can be applied (Churchill and Lacobucci 2002). In every CVM study, the representativeness of the household sample should not be taken for granted and should always be evaluated.

Closely linked to the choice of the target population and the sampling method is the choice of the survey mode. CVM surveys can be conducted as in-person surveys e.g. employing face-to-face or telephone interviews, or in a self-administered way as mail or internet surveys. Choosing the appropriate survey mode is crucial because it determines the list of households from which the sample will be drawn. The key is to have the sample frame that is consistent with the target population. For instance, a mail survey is not suitable if the population of interest is dwellers in a mountainous area where access to postal services may be limited. Conducting a face-to-face survey is more appropriate in this case. In addition, the choice of survey mode is important because it can affect the WTP stated by survey respondents (Loomis and King 1994; Ethier et al. 2000; Davis 2004). Of all modes, the face-to-face interview is claimed to be superior. Data gathered from this mode of interview are regarded as the benchmark of CVM results (Arrow et al. 1993). The decisive feature of the face-to-face survey is that it provides possibilities for interviewer-respondent interactions. Interviewers can direct the sequence of questions, manage complex WTP elicitation questions, and employ different media (e.g. print, audio, or video) in the interview. If needed, respondents can also ask for clarification of any unclear points of the scenario. The drawback of this mode is that the presence of the interviewer

may influence respondents' answers (interviewer biases) and that respondents are only given a limited of time to complete the questionnaire (Bateman and Mawby 2004; Davis 2004; Svedsäter 2007). Eventually, the need for a large number of interviewers and their need to physically visit respondents in their homes make face-to-face surveys one of the most costly survey modes.

Questionnaire design

A properly-designed questionnaire is a prerequisite for any CVM survey. A number of studies attempt to lay down general guidelines for the CVM survey instrument, such as Bateman et al. (2002) or Mitchell and Carson (1989). The most notable attempt has been made by the blue-ribbon panel commissioned by the National Oceanographic and Atmospheric Administration (NOAA) in 1993 (Arrow et al. 1993). Many of the standards set by the panel are considered as the "best practices" of the CVM until today. This section reviews the procedure of CVM studies in detail. Important literature that should also be consulted include Carson and Hanemann (2005).

A typical CVM questionnaire consists of five main parts. CVM interviews typically start with a brief introduction of the survey: who is responsible for the survey, the survey objectives, time of the interview, and what researchers intend to do with the survey results. If they agree to participate in the survey, respondents are then presented with warm-up questions which are intended to build up their confidence before they are asked questions that require more cognitive effort. Thereafter, respondents are asked about problems with respect to the current environmental state, their mitigation strategies at present, and their worries about the future of the environmental good. It is expected that respondents' memories with respect to the environmental good in question is refreshed as they are guided through these questions, and are asked to recall their experiences with the good.

The second part of the questionnaire contains a detailed description of the environmental changes resulting from a planned environmental project. The description of the scenario is one of the most crucial components of a CVM study because respondents are often unlikely to have had direct experience with the proposed improvements. Consequently, utility changes expected by respondents often depend solely on the information provided and the scenarios described. The scenario presentation begins with a description of the current state of the environmental good to be valued, its *status quo*. This includes its geographical extent, its utilization, and problems associated with the use of the environmental good. Information regarding the

availability of substitutes which may affect respondents' values should also be given. Subsequently, respondents are presented with the planned improvements of the state of the respective environmental good. They are provided with details of how these improvements can be achieved, including measures to be carried out, the responsible organizations, and the timeframe of the proposed program. The scenario must also describe the final state of the environment after the project has been undertaken: what it will look like, and what will be the expected benefits from the improvements. All these details are important for the respondents to be able to imagine how much this project will increase their utility. The biggest challenge with respect to the scenario presentation is to provide the optimal amount of information so as to enable all individuals to make informed decisions on the one hand, and to avoid overloading respondents with information on the other.

The third part of CVM questionnaire is the presentation of the hypothetical market setting. This is the part where respondents are informed that in order for the proposed project to be realized a contribution of the prospective beneficiaries, i.e. the households, would be required. The hypothetical market is defined by the implementation and the payment rule. The implementation rule identifies the conditions under which the project will be carried out. A common implementation rule is a statement like: "the proposed environmental project will be carried out only if the money collected can cover the costs for the implementation of the project." The payment rule specifies how the contributions to the project that households are going to state in this study will be actually collected when the project is implemented. A common payment rule is a statement like: "if the proposed project is implemented your household will be asked to exactly the amount you stated in this study." Another important aspect of the payment rule, is the payment vehicle. The payment vehicle is the means by which respondents can contribute to the project (e.g. tax increases, direct fees, or voluntary donations). In general, coercive payments (fees and taxes) are preferred over other voluntary payment means, such as donations. This is because donations are prone to the problem of "free riding", which arises when people want to enjoy the consumption of a public good but do not contribute to the costs for its provision (Champ and Bishop 2001; Wiser 2007). Moreover, the payment should be coercive because asking people to contribute voluntarily might reduce the credibility that the fundraising objective will be achieved, and thus people may be less likely to reveal their true WTP (Champ et al. 1997). In order to incentivize respondents to truthfully state the maximum amount of money they are willing to contribute to the realization of the proposed project, the specification of hypothetical market setting has to be done with extreme care.

The fourth part of the questionnaire is the WTP elicitation question. A cluster of different elicitation question formats have been devised and tested over the years. The simplest method is to directly ask respondents to state the exact amount of their WTP for the project: "What is the maximum amount of money that you would be willing to pay for the project to be implemented?" Other formats involve, for example, confronting respondents with predefined "bids" for the proposed project which they can choose to accept (if their maximum amount of WTP is equal to or higher than that proposed bid) or decline (if their maximum amount of WTP is smaller than the proposed bid). An alternative method asks respondents to select from a list of payment amounts that amount they are willing to pay to secure the realization of the proposed project. It should be noted the different WTP question formats have been found to potentially bias WTP answers given by respondents. Thus, this topic will be picked up and discussed in more detail in the next section.

In the fifth part of the CVM questionnaire, respondents are usually presented with attitudinal and socioeconomic questions. These questions aim to collect data regarding the households' social and economic conditions. Information obtained from this last section of the questionnaire is used to estimate the determinants of WTP answers. The identification of WTP determinants is useful because it enables policy makers to learn about the groups of people who receive positive or negative consequences of the proposed environmental program. WTP determinants can also be employed as internal validity tests to check whether stated WTP is determined by certain respondent-specific variables as predicted by theory.

Elicitation question formats

As mentioned in the preceding paragraph, there are various elicitation methods. Here, three major ones will be highlighted: the open-ended (OE), payment card (PC) and dichotomous choice (DC) formats. For other formats, the reader should consult Bateman et al. (2002). The basic idea of the OE elicitation format, which was widely used in the 1970s and 1980s, is to directly ask survey respondent to specify the exact amount they are willing to pay for the proposed project. The biggest advantage of this question format is that mean WTP of the sample can be directly calculated as the average stated WTP by all respondents. However, the OE format suffers from a number of problems, such as large non-response rates and high numbers of outliers (Bateman et al. 1995). These problems stem from the fact that respondents are not familiar with the task of valuing the environmental good in question, so they are uncertain about the utility level that can be expected from the proposed project, let alone stating the exact amount

of money that best represents their utility change (Hanemann 1984). Consequently, many respondent might leave the WTP question unanswered or state a very high, but unrealistic, amount. Due to these problems the NOAA panel concluded that the OE format is unlikely to provide reliable and valid valuation results (Arrow et al. 1993).

The PC format presents respondents with a payment card consisting of different intervals for WTP answers; respondents are asked to select an interval in which their WTP lies. Typically, payment cards contain values that range from zero to a very high WTP interval, which is considered to be an unrealistically high WTP response, to make sure all potential WTP answers can be stated on that card (see Figure 2-2).

Figure 2-2: Example of the payment card elicitation format

Please select from the following list of payment categories the one that contains the highest amount you would be willing to pay per month (in Euro).					
A	0 – 5	G	41 – 50	M	141- 170
B	6 – 10	H	51 – 60	N	171 – 200
C	11 – 15	I	61 – 80	O	201 – 230
D	16 – 20	J	81 – 100	P	231 – 300
E	21 – 30	K	101 – 120	Q	301 – 400
F	31 – 40	L	121 – 140	R	over 400

The advantage of the PC format is that while it offers the advantage of the OE format (i.e. respondents can freely express their maximum WTP), it also gives more guidance to respondents as to the realistic range of WTP amounts. Therefore, the problem of outliers of stated WTP is alleviated. Respondents do not have to state the exact amount of WTP because on the payment card WTP amounts are presented in intervals. However, a big disadvantage of the payment card is the possibility of range and centering biases (Rowe et al. 1996). Range bias occurs when respondents' stated WTP are influenced by the value of the highest payment interval and thus of the range of the card as a whole. It has been shown that respondents tend to give higher WTP when the last payment interval contains higher values (Whynes et al. 2004). Centering bias occurs when interviewees tend to give stated WTP that are close to the value of the middle payment interval (Arrow et al. 1993).

The last major elicitation method that has attracted a great deal of attention from CVM researchers is the dichotomous choice question format (DC). In the DC, respondents are confronted with a WTP bid and directly asked whether they want to pay that specific amount of

money to support the proposed project or not. Initially, there was only a single-bounded DC question format, where only one WTP bid was proposed (Bishop and Heberlein 1979). Double-bounded DC was proposed thereafter (Hanemann 1985). The double-bounded DC asks respondents two consecutive questions. In case respondents agree to pay the first bid, the double-bounded DC presents respondents with a higher bid and asks whether they still would pay this higher amount. In case respondents reject paying for the first bid, they are confronted with a lower WTP bid. It is clear that the double-bounded DC can extract more information from one respondent than single-bounded DC. One of the advantages of the DC format is that its question format is analogous to the market situation where people are confronted with a take-it-or-leave-it type of decision. Therefore it might be easier for respondents to answer. Moreover, by reducing choice set to a simple yes-no answer, the DC is able to induce a truthful revelation of individual preferences. This means, respondents will always perceive it as their best choice to agree to pay the bid if their appreciation for the project is as high as the bid amount.

Despite its advantages, a number of problems regarding the use of the DC format have been discussed. WTP estimated from DC questions are prone to suffer from starting point bias that is respondents are influenced by the amount of the initial WTP bid (Ryan et al. 2004). The starting point bias may be caused by the fact that respondents are uncertain about the act monetary amount that reflects their expected utility change. Consequently, they may think that the initial bid represents a hint to the value of the good in question. Another explanation of the starting point bias could be attributed to the so called "yea"-saying behavior (Ryan et al. 2004). Yea-saying behavior happens when respondents feel tempted to accept the proposed bid by saying yes irrespective of the amount of the proposed bid and the amount of their "true" WTP. Apart from the widely observed starting point bias, the DC format requires a much larger sample size than other elicitation formats in order to produce reliable benefit estimates. To sum everything up, different elicitation formats have their own advantages and disadvantages which should be considered when selecting the elicitation format for a CVM survey. In the next section, the statistical methods used to analyze WTP data obtained from these different elicitation questions will be introduced.

2.3.2 Analysis of CVM data

After collecting WTP responses from the sampled households in a CVM study, there are a number of steps to statistically compute mean WTP of the sample. These technical steps are needed because of three main reasons (Bateman et al. 2002). Firstly, the elicitation question formats used in the CVM do not always produce precise figures for each household's WTP. It

was mentioned that only the OE format produces precise WTP statements. Other formats such as DC and PC produce only WTP statements as interval data. Secondly, only the sampled, not all, households are interviewed for their stated WTP, which makes it necessary to determine the level of confidence with which the sample means can be extrapolated to the whole population in the sample frame. For these reasons, certain statistical methods are needed to estimate the mean WTP which can then be multiplied by the total number of households in the population to arrive at the social value of the proposed environmental project. Thirdly, a statistical estimation must also be employed to find the determinants of WTP. Information on the determinants helps researchers to identify the characteristics of households that obtain more or less benefits from the environmental project. The information on which variables have an impact on people's WTP statements can also be used for the validation of WTP statements.

For the OE format which produces continuous WTP data, the calculation of mean WTP is rather straightforward. No parametric models are required because when the OE format is used, respondents are asked to state the exact amount of money that they would be willing to pay for the program considered. The obtained WTP statements can simply be averaged to produce the mean WTP of the survey sample. However, the result is the mean WTP of the sample households but not of the population. The two are not necessarily identical because sampling procedures naturally incur errors. To infer the population mean using the rather unreliable sample mean, a confidence interval must be calculated. The confidence interval indicates that range of values that the estimate of interest will assume with a specified level of certainty. As general practices, researchers employ certainty levels of 90%, 95%, or 99%. For example, the 95% confidence interval implies that from 100 times the sampling is repeated, there are 95 times that the true parameter of the population falls in that interval. The following formula is used: 95% confidence interval of $\mu = \bar{x} \pm 1.96 \left(\frac{S.D.}{\sqrt{N}} \right)$, where μ represents the mean of the population, $\bar{x}$ denotes the sample's mean, S.D. is the standard deviation of the mean, and $\sqrt{N}$ is the square root of the sample size (Berry and Lindgren 1996).

Estimating the determinants of WTP for OE data is equally straightforward. Simple regression techniques, usually Ordinary Least Squares regression (OLS), can be used. The stated WTP is taken as the dependent variable and the socio-economic and attitudinal characteristics are taken as the independent variables. But as OE datasets usually consist of a high proportion of zero responses and no nonnegative WTP statements, the use of simple of OLS will produce biased parameters. As a consequence, it is more correct to use parametric

models that can deal with censored datasets, such as the tobit regression model. The topic which will be discussed at the end of this section.

For other elicitation question formats like the DC and the PC, the estimation of the mean WTP and its determinants is a little more challenging. Both single- and double-bounded DC formats produce binary data indicating whether or not respondents accept or reject the proposed bids. Without further calculations, we will only know that the WTP of a respondent is more or is less than some specified amount of money. Unlike the OE question, the WTP that respondents had in their mind when answering DC questions remains unrevealed. To estimate the mean WTP from the yes/no responses, the idea is to model the underlying utility difference problem that is solved by survey participants when accepting or rejecting the proposed bid. The aim here is to take accurate account of important factors determining the yes/no decisions of households including the underlying WTP itself. This is the basic idea of the utility difference approach which is a dominating approach to estimate respondents' WTP from DC data (Hanemann 1984). The details of this approach are as follows.

As the DC format produces binary data indicating whether or not an individual household $h, h \in [1,2, \ldots, H]$ with certain demographic and socio-economic characteristics s_h accepts a bid amount, a decision model based on the characteristics of that household is needed. It is therefore assumed that household h has the following indirect utility function

$$v_h = v_h(I_h, z^i, s_h), \tag{2-21}$$

where $v_h(I_h, z^i, s_h)$ represents the indirect utility function of household h. It represents the maximum obtainable level of utility that the household can obtain given the level of environmental goods z^i ($i = 0$ refers to the situation before the implementation of the project, and $i = 1$ is the situation after), the disposable income of the household I_h, and the vector of the households' socio-economic and attitudinal characteristics s_h.

When a "yes" response from household h, to a proposed bid t_h in a CVM survey is received, it can be expected that the utility of household h, after making the payment of t_h, is still at least as high as the utility in the status quo (otherwise household h would have answered "no" to the required payment). That means for those households who accept the required payment it holds that

$$v_h(I_h, z^0, s_h) \le v_h(I_h - t_h, z^1, s_h), \tag{2-22}$$

The weak inequality in (2-22) can be inferred from any "yes" response to a DC question in a CVM survey as long as the sampled households aim to maximize their utility, which this approach assumes. Nonetheless, if the household answers "yes" for other reasons, e.g. to please interviewers, the inequality (2-22) will not be applicable anymore. The design of a CVM study must ensure that the "yes" response can be explained by (2-22). Further, the inequality (2-22) implies that for the "yes" response to be meaningful, household h must have a clear idea about the change of its welfare between situations 0 and 1. If not, the WTP response, as well as its statistical estimate, will not represent the actual utility changes that the household expects from the project. In the next steps, the parametric version of the weak inequality in (2-22) shall be introduced.

The weak inequality in (2-22) is of course only an illustration of what might happen in respondents' heads when giving a "yes" answer to the DC question format. The true rationales for this answer are unobservable by nature. This means that the true form of $v_h(I_h, z^i, s_h)$ is unknown to the analyst. So the aim of this approach is the approximation of the real form of $v_h(I_h, z^i, s_h)$. This leads to the core idea underpinning the framework of the Random Utility Model (RUM) as developed by McFadden (1974). According to the RUM, the true indirect utility function of household h consists of two parts: the deterministic term $\bar{v}_h(I_h, z^i, s_h)$. representing the approximation of the real indirect utility function made by the analyst and the stochastic term ε_h^i which refers to the part of the true indirect utility function that is unobservable for the analyst and thus can only be taken into account implicitly. Household h's level of utility can thus be expressed as:

$$v_h(I_h, z^i, s_h). = \bar{v}_h(I_h, z^i, s_h). + \varepsilon_h^i. \tag{2-23}$$

The framework of the RUM shown in (2-23) will be used as a building block for the statistical estimation of mean WTP and its determinants. Equation (2-22) will be transformed according to the RUM framework. Further, the analyst can only investigate the WTP responses in terms of probability. The probability of a respondent to accept the proposed bid t_h reads:

$$Pr\{yes_h\} = Pr\{\bar{v}_h(I_h, z^0, s_h) + \varepsilon_h^0 \leq \bar{v}_h(I_h - t_h, z^1, s_h) + \varepsilon_h^1\}$$

$$= Pr\{\varepsilon_h^0 - \varepsilon_h^1 \leq \bar{v}_h(I_h - t_h, z^1, s_h) - \bar{v}_h(I_h, z^0, s_h)\}. \tag{2-24}$$

From equation (2-24), it can be seen that the probability of household h to accept the required payment of t_h (and to say "yes" to the DC question) depends on the deterministic part of the indirect utility function, i.e. the part that is based on the observable characteristics of households, and its stochastic part, i.e. the part that is based on the unobservable characteristics of households or measurement errors. The larger the deterministic utility difference the higher the probability that it will exceed the stochastic utility difference and the higher the probability that household h will not experience a utility loss from contributing to the environmental project and therefore tend to say "yes" to WTP question. Given that $\varepsilon_h^0 - \varepsilon_h^1 = \varepsilon_h$ and that $\bar{v}_h(I_h - t_h, z^1, s_h) - \bar{v}_h(I_h, z^0, s_h) = \Delta\bar{v}_h$, the probability that the random variable ε_h is less than Δv_h can be expressed in terms of the cumulative distribution function of ε, $F_\varepsilon(.)$. Equation (2-24) can be rearranged into

$$Pr\ \{yes_h\} = F_\varepsilon(\Delta\bar{v}_h).\qquad\qquad(2\text{-}25)$$

If the binary response obtained from the DC format is to be interpreted as the utility maximizing choice, it must be expressed by equation (2-25). Thus, this equation provides a criterion for investigating whether a given statistical model for estimating DC responses is consistent with the economic theory of utility maximization. It also provides a starting point for specifying the functional forms of statistical models so that the related variables can be estimated (Hanemann 1984). Both $\Delta\bar{v}_h$ and $F_\varepsilon(.)$ are only general terms representing variations of functions. They have to be specified. For $\Delta\bar{v}_h$, the form of utility function that is often employed is linear in income and other observable characteristics of the household s_h (Bateman et al. 2002). These other observable characteristics of the household will now be aggregated in α but a model to explicitly take them into account will be introduced below. The linear utility function can thus be expressed as

$$\bar{v}_h = \alpha + \beta I_h,\qquad\qquad(2\text{-}26)$$

where β represents marginal utility of income. After the form of utility function is specified, the deterministic utility difference $\Delta\bar{v}_h$ can now be expressed as:

$$\Delta\bar{v}_h = \bar{v}_h^1 - \bar{v}_h^0 = (\alpha^1 + \beta(I_h - t_h)) - (\alpha^0 + \beta I_h)$$

$$= \alpha - \beta t_h,\qquad\qquad(2\text{-}27)$$

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where $\alpha = \alpha^1 - \alpha^0$. It should be noted that other forms of indirect utility functions are available (Bateman et al. 2002). However, as the focus of this study is not on examining the influences of differences in the parametric specifications of utility on the estimation of WTP but on the methodological improvement of the CVM, it seems justified to employ this version of the indirect utility function.

After the form of utility function is specified, the only task left is to assume the form of the distribution of the error term ε_h^i. For the purpose of simplification, ε_h^i is assumed to be independently and identically distributed with mean zero. Further, ε_h^i is assumed to follow a normal distribution. With these specifications, $F_\varepsilon(\Delta\bar{v}_h)$ becomes $\Phi(\Delta\bar{v}_h)$, with $\Phi(.)$ being the standard normal cumulative distribution function. The result is the probit model for WTP estimation.[2] The error term of the probit model is assumed to be normally distributed with a mean of 0 and variance of 1, that is $\varepsilon_h^i \sim N(0,1)$. Since the error term ε_h^i is distributed with $N(0,\sigma^2)$, the parameters α and β have to be normalized to $\frac{\alpha}{\sigma}$ and $\frac{\beta}{\sigma}$, $\Phi(\Delta\bar{v}_h)$ thus becomes $\Phi(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h)$, and equation (2-25) reads:

$$F_\varepsilon(\Delta\bar{v}_h) = \Phi(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h) \tag{2-28}$$

After all functions are specified, the initial task of calculating the WTP can now be approached. First related variables that are necessary for the calculation of the mean WTP have to be identified. Afterwards, it is explained how they can be estimated. Considering equation (2-27), by assuming that the proposed bid t_h is exactly equal to households' WTP, it follows that the utility difference of household h between the initial state of the environment and the final state of the environment is zero, i.e. $\Delta\bar{v}_h = 0$. Equation (2-27) now reads: $0 = \alpha - \beta WTP_h$. So that

$$WTP_h = \frac{\alpha}{\beta}. \tag{2-29}$$

Because mean WTP is to be calculated, the aim is to find α and β that best represent those of all individual households. The task then boils down to deriving α and β from the "yes" and "no"

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[2] An alternative distributional assumption that is often made with respect to ε_h^i and should be mentioned here is the standard logistic distribution. This leads to the so-called logit model for WTP estimation. Both the probit and the logit model have dominated the estimation of the WTP datasets obtained from the binary choice format. There is minute difference between the two: the standard logistic distribution assumes a higher probability density at the tails of the distribution than the standard normal distribution.

responses in the survey dataset. The maximum likelihood method (MLM) is used for this purpose. The MLM begins with the construction of a likelihood function, which models the occurrence of all observations. In this case, the observations of interest are the "yes" and "no" responses. The likelihood function is maximized by finding those parameters α and β that maximize the likelihood of the model to the pattern of responses that was actually obtained.

With the help of the parametric model specified in (2-28), the specific likelihood function can be developed. For the single-bounded DC format, the likelihood function using the probit specification reads:

$$L\,(\alpha, \beta | t_h) = \prod_{h=1}^{H} \left[\Phi(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma}\, t_h\,) \right]^{yes_h} . \left[1 - \Phi(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma}\, t_h\,) \right]^{1-yes_h}. \qquad (2\text{-}30)$$

Equation (2-30) represents the probability of the occurrence of *all* the "yes" and "no" responses. Now, to fit the model to the dataset it is necessary to fill in variables yes_h and t_h. If the household answers "yes" to the proposed bid, yes_h is 1 and (2-30) collapses leaving only the first term. If the household's response is "no," yes_h is 0 and only the latter term of (2-30) remains. For t_h the amounts of the proposed bid are filled in. With this process, there will be the multiplication of H terms as the right hand side of equation (2-30). As it is easier to work with summation rather than multiplication, the likelihood function is often transformed to the log-likelihood function

$$ln\,L\,(\alpha, \beta | t_h) = \sum_{h=1}^{H} yes_h . ln \left[\Phi \left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma}\, t_h\, \right) \right]$$

$$(2\text{-}31)$$

$$+(1 - yes_h). ln \left[1 - \Phi(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma}\, t_h\,) \right]$$

The next step of the MLM is to find the values of α and β that produce the greatest possibility that all observations will occur simultaneously, i.e. that maximizes equation (2-31). The estimation of parameters using the MLM depends on an iteration process. In the calculation, certain starting values for the parameters α and β are chosen and fed into the model resulting in the likelihood estimate according to (2-31). This process is repeated and continues until it is not possible to find other values of the parameter estimates that bring about a greater likelihood

function. The actual calculation can be done using a statistical software package such as LIMDEP or STATA. For the double-bounded DC format the likelihood function becomes:

$$\ln L \left(\alpha, \beta \big| t_h^{low}, t_h, t_h^{up} \right) = \sum_{h=1}^{H} YesYes_h . \ln \left[1 - \Phi \left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h^{up} \right) \right]$$
$$+ YesNo_h . \ln \left[\Phi \left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h^{up} \right) - \Phi \left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h \right) \right]$$
$$+ NoYes_h . \ln \left[\Phi \left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h \right) - \Phi \left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h^{low} \right) \right]$$
$$+ NoNo_h . \ln \left[\Phi \left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h^{low} \right) \right] \qquad (2\text{-}32)$$

where t_h refers to the first proposed bid, t_h^{low} refers to the second lower bid, and t_h^{up} refers to the second upper bid. The estimated parameters α and β obtained from the maximum likelihood method can be used to compute mean WTP according to (2-29). Since mean WTP is calculated from the ratio of two parameter estimates each with its own standard error, the calculation of the 95% confidence interval is not as straightforward as in the case of OE data. The bootstrapping method developed by Park et al. (1991) is recommended. This method utilizes data obtained from the estimated coefficients, together with variance and covariance matrices to randomly estimate mean WTP 1,000 times. To calculate a 95% confidence interval of mean WTP the first and last 25 from these 1,000 WTP estimates have to be eliminated. This will result in 950 stated WTP estimates the first and last of which are the boundaries of the 95% confidence interval of the mean WTP.

It has been mentioned that another aim of the CVM is the identification of determinants of WTP. With regard to this issue, WTP determinants can be investigated using the extended version of the linear utility model presented in (2-27):

$$\Delta \bar{v}_h = \alpha - \beta t_h + \gamma_j s_{hj}, \qquad (2\text{-}33)$$

where the vector s_{hj}, $j = (1,2,...,J)$ consists of J socio-economic, demographic, or attitudinal characteristics of the households, γ_j refers to the parameter vector of the J observed variables of the vector s_{hj}. WTP determinants are those variables of the vector s_{hj} that have significant influences (positive or negative) upon the WTP.

For the DC dataset of this study, parameters α, β, and γ_j will be estimated based on the probit model. For the PC dataset, two estimation methods for the calculation of mean WTP are possible. First, the mean WTP can be assessed using interval data. In this case, any bid interval in the payment card can be described as (t_h^{low}, t_h^{up}). When a payment card is selected by respondents it can be interpreted using the logic of the DC approach in that they accept t_h^{low} and reject t_h^{up}. The log-likelihood function for the PC dataset therefore reads:

$$ln\, L\left(\alpha, \beta \middle| t_h^{low}, t_h^{up}\right) = \sum_{h=1}^{H} ln\left[\Phi\left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma}\, t_h^{up}\right) - \Phi\left(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma}\, t_h^{low}\right)\right] \qquad (2\text{-}34)$$

Alternatively, the analyst could also calculate the midpoints of each response interval and directly calculate mean WTP based on these midpoints. In this case, there is no need for any parametric estimation technique. The computation of mean WTP based on midpoints frees researchers from the uncertainty regarding the correct distribution for dataset. It also releases researchers from the need to make a number of distributional assumptions that would be required if the interval data were used. When using interval midpoints to represent WTP responses the calculation of the 95% confidence interval is simple as it is the same formula as for OE data. This study employs both DC and PC question formats in the empirical CVM survey. For the DC dataset, there is no alternative technique for estimating the mean WTP. Therefore, mean WTP will be estimated based on the log-likelihood model introduced in (2-32). For the PC dataset, the computation of mean WTP based on midpoints will be used to simplify the WTP analysis and the tobit model will be employed, because PC data is censored at zero.

Whenever the dependent variable in a model is not distributed freely but cut off at some point a regression model for censored data is needed. The PC dataset is clearly censored as no negative WTP responses are recorded. With a censored dataset, the Ordinary Least Square estimation is not suitable because it will yield biased and inconsistent parameter estimates (Tobin 1958). The alternative tobit model assumes that there is a latent variable (WTP_h^*). This latent variable cannot be observed, and it is determined by the socio-economic, demographic, and attitudinal characteristics of the households represented by the vector s_h. The magnitude of their effect on the latent variable WTP_h^* is captured by the parameter vector γ. On top of that, the normally distributed error term $(\varepsilon_h \sim N\,(0, \sigma^2))$ captures the error effect in the linear relation. This alternative tobit model reads:

$$WTP_h^* = \gamma s_h + \varepsilon_h \qquad\qquad (2\text{-}35)$$

The latent variable can be observed in terms of the observable variable $(\overline{WTP}_h)$ only if WTP_h^* is greater than zero. Otherwise the latent variable is set equal to zero. The observable variable $\overline{WTP}_h$ is therefore defined as:

$$\overline{WTP}_h = \begin{cases} WTP_h^* & \text{if} & WTP_h^* > 0 \\ \\ 0 & \text{if} & WTP_h^* \leq 0 \end{cases} \qquad\qquad (2\text{-}36)$$

Equation (2-36) indicates that for households who state their WTP for the proposed program, these WTP statements are assumed to have a linear relationship with their socio-economic or attitudinal characteristics and other random influences. Coefficients of the variables in the tobit model will also be calculated with the maximum likelihood method.

The likelihood function of the PC elicitation format using the tobit specification consists of two parts. The first part captures the probability of observing a stated WTP of zero $Pr(\overline{WTP}_h = 0) = Pr(WTP_h^* \leq 0) = Pr(\varepsilon_h \leq -\gamma s_h) = Pr\left(\frac{\varepsilon_h}{\sigma} \leq \frac{-\gamma s_h}{\sigma}\right) = \Phi\left(\frac{-\gamma s_h}{\sigma}\right)$. Because of the symmetry of the distribution $\Phi\left(\frac{-\gamma s_h}{\sigma}\right) = 1 - \Phi\left(\frac{-\gamma s_h}{\sigma}\right)$. The second part of the likelihood function stems from the uncensored observations and can be expressed as $\frac{1}{\sigma} \Phi\left(\frac{\overline{WTP}_h - \gamma s_h}{\sigma}\right)$. The likelihood of the PC format using the tobit specification reads:

$$L(\gamma|s_h) = \prod_{h=1}^{H} \left[1 - \Phi\left(\frac{-\gamma s_h}{\sigma}\right)\right]^{\overline{WTP}_h = 0} \cdot \left[\frac{1}{\sigma} \Phi\left(\frac{\overline{WTP}_h - \gamma s_h}{\sigma}\right)\right]^{\overline{WTP}_h > 0}. \qquad (2\text{-}37)$$

This likelihood model can be converted into a log likelihood function, which can then be maximized in order to determine the parameters γ that are most likely to have generated the observed data.

2.4 Discussion of the quality of the CVM

After major techniques of environmental valuation have been introduced, one important topic that is critical for justifying the use of these methods is the assessment of their quality. How good are these valuation methods? How much faith can one put in environmental values

assessed and estimated by these techniques? The main objective of this section is therefore to discuss the quality of environmental valuation techniques, with a special focus on the contingent valuation method. It should be mentioned at the outset that the quality of valuation techniques such as the CVM is traditionally addressed based on the concepts of validity and reliability. Validity refers to the degree to which the method measures the concept it is intended to measure. Reliability refers to the consistency of environmental values produced by means of different environmental valuation methods or at different points in time. Valuation techniques are considered to be reliable when they yield results that are stable over time. However, this section will discuss only issues related to validity. The replicability of CVM results is not considered.

The rest of this section is organized into three parts. The first part reviews empirical evidence on the validity of CVM results. It will be shown that these validity studies lead to the detection of typical errors and systematic biases of WTP statements. The second part, section 2.4.2, identifies the main sources of errors and biases of CVM results. The third part reviews studies that directly investigate the mental processes that lead to the stated WTP to prepare for the discussion of the influence of personality traits on environmental values, the main focus of this study.

2.4.1 Validity of CVM surveys: Evidence form three aspects of validity

For many measurement tools, the verification of their measurements cannot be any simpler. One can, for example, count bottles in a crate to check a reverse vending machine's precision, or one can use the true north (e.g. Northern Star) as a reference point for the magnetic north identified by a compass. But this is not the case for the CVM. There is no figure on the correct WTP answers that can be used to verify the response given by each survey participant. Nor is it possible to look inside people's heads and monitor what they are thinking when giving WTP answers. Instead, researchers accumulate findings on the various conventional validity criteria in search for conclusive evidence supporting the validity of a measurement. Some contrast CVM estimates with indicators of what theoretically should be measured (criterion validity). Some compare CVM results to welfare measures obtained from different valuation techniques (convergent validity). Others assess whether CVM results relate in particular ways to predictors identified by economic theory (theoretical validity).

Criterion validity

The basic principle of criterion validity is to test the comparison between the value measurement and what is known to be correct. In the context of CVM, criterion validity implies the comparison between the practical WTP estimates with a criterion assumed to represent the true WTP. This is problematic because the true WTP is unobservable by its nature. To circumvent this problem, other criteria of the true WTP are used. These include: actual voluntary contributions to public goods (Champ et al. 1997; Veisten and Navrud 2006) and binding referendum responses (Cummings and Taylor 1999; Vossler and Kerkvliet 2003; Johnston 2006). By employing these alternative criteria, these studies detect significant differences between practical WTP estimates and criteria of the true WTP with the former significantly exceeding the latter (Neill et al. 1994; Cummings and Taylor 1999; List 2001; Veisten and Navrud 2006).[3] As a consequence, these studies have brought to attention the problem of hypothetical bias –the tendency for CVM respondents to inflate their WTP answers when there are no commitments to their answers.

The detection of hypothetical bias invites critical evaluations of the features of the CVM survey that may pose real threats to the validity of the method if they are left untreated. In addition, it leads to the development of *ex ante* and *ex post* treatments. Such an *ex ante* approach includes increasing the level of commitment from the part of the respondent by using so-called "cheap talk." (Cummings and Taylor 1999). Basically, such a cheap talk script describes the problem of hypothetical bias and the request to survey participants to avoid repeating it. However, results from the use of this method are rather mixed (Cummings and Taylor 1999; Aadland and Caplan 2006). One of the *ex post* methods involves the use of certainty scales to eliminate answers from respondents that are not entirely certain of their WTP answers (Champ et al. 1997). Findings from experimental studies show that WTP answers given by "certain" respondents are very close to the actual payment (Blumenschein et al. 2008; Morrison and Brown 2009). Another type of studies show that such emphasizing the level of realism of the exercise, the degree of hypothetical biases can be reduced. For example, Veisten and Navrud (2006) sent mails to 2,498 recipients asking them for their WTP into a fund to finance the protection of forest areas in Norway. Recipients also received an invoice for actual payment. One group of the participants received the invoice simultaneously with the questionnaire while another group obtained the invoice one week after returning the questionnaire. Results showed

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[3] It is worth noting that not all criterion validity studies obtain the same result. Many studies found that there is no statistical difference between hypothetical and actual payments (e.g. Johnston 2006, Vossler and Kerkvliet 2003).

that respondents who received invoice simultaneously with the questionnaire halved their WTP answers compared to those who faced only the questionnaire first.

Convergent validity

Convergent validity refers to the test of whether the measurement is converge (diverge) to other tests believed to measure the same construct. In the context of the CVM, convergent validity tests compare welfare measures obtained from the CVM and measures obtained from other environmental valuation methods. An obvious shortcoming of the convergent validity assessment is that it is not possible to identify which measure has a superior quality (in terms of a closer approximation of the true value of the environmental project in question). This is also the reason why insights obtained from this validity criterion are limited.

Up to a point in time, estimates from indirect valuation methods (e.g. the TCM and the HPM) had been employed to judge the validity of CVM estimates. This is because economists historically had more trust in information revealed in the market. The assumption was that that both the TCM and the HPM produce a lower bound of the welfare measurement. In an influential review conducted almost 20 years ago, Carson et al. (1996) reviewed a total of 83 studies which altogether provide 616 comparisons of the CVM estimates and revealed preference estimates. The authors showed that estimates from the CVM are a little (though significantly) smaller than those of the indirect valuation techniques. At first glance, this result points to the invalidity of CVM results. The CVM which measures the non-use as well as use values of the environment should give larger (not smaller) estimates than the revealed preference methods that assess only the use value of environmental goods. A closer look reveals that such a result is difficult to interpret due to a number of reasons. First, the CVM, TCM and HPM address "overlapping but not identical" value sets (Bateman et al. 2002, p.314). While the TCM and HPM take an ex-post perspective and exclude the non-use value component, the CVM takes an ex-ante view, which cannot be derived from direct experience with the environmental change under consideration, and measures both use- and non-use values. This means welfare measures obtained from the CVM, TCM and HPM may not have any expected ordering because they are based on different types of valuations. Second, estimates of indirect valuation methods are suffering from methodological shortcomings of their own (see section 2.2.1). Thus, their validity cannot be taken for granted, either. Putting everything together, it means that first the theoretical correlation patterns between estimates obtained from the CVM and the TCM and HPM must be found before comparisons of practical valuation outputs can be meaningfully interpreted.

A similar problem is found regarding the comparisons between estimates obtained from the CVM and direct valuation methods like the ABCM and the PVM.[4] None of these methods can claim superiority in terms of producing estimates that are closer to the true welfare changes households expect from the environmental project. Thus, results from the comparisons can mean almost everything (or in other words, almost nothing). For example, the convergence between WTP measures obtained from the three methods does not necessarily mean that both of them are valid. They may be equally invalid and results biased in the same direction. At the same time, divergence between welfare estimates does not necessarily imply that the estimates are invalid. The above mentioned findings imply that convergent validity tests cannot provide conclusive evidence on the validity of the CVM results.

Theoretical validity

This part reviews studies which try to verify WTP estimates based on expectations derived from economic theory. The common objective of these studies is to analyze whether WTP estimates exhibit properties which conform to those of the Hicksian Compensating Variation. Arguably, among different types of validity tests reviewed in this section, the theoretical validity test provides most insights into the quality of CVM results. Theoretical validity test does not compare welfare estimates to external criteria the quality of which is unknown, but it directly compares the empirical properties of CVM estimates with the theoretical properties of the Hicksian Compensating Variation. Results indicate how well the properties of valuation results correspond to those of the theoretical construct one intends to measure. Most of the biases detected in CVM surveys result from violations of theoretical validity. Some of such bias will be introduced below.

A range of studies setting out to test theory-driven expectations found that practical WTP estimates are insensitive to certain theoretically relevant factors or that WTP measures are overly sensitive to other theoretically irrelevant variables. As a result, a number of irregularities and biases of CVM results have been brought to light. Biases of the former category are detected when estimates from the CVM do not sufficiently correspond to expectations derived from conventional economic theory. They refer to problems such as part-whole bias or embedding. Biases of the latter category are detected whenever stated values are influenced by any

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[4] Studies comparing estimates of the CVM with those of the ABCM and PVM show slightly lower welfare estimates of the former (Lienhoop and Macmillan 2007, Mogas et al. 2006, Jin et al. 2006).

procedural or situational factors which should not have any effects on the stated WTP. These include, for instance, protest responses and biases associated with elicitation question formats (e.g. starting point and range biases).

Let us consider first the detection of the so-called embedding and part-whole bias. This bias describes the finding that WTP estimates obtained from the CVM are not sufficiently responsive to differing quantities and qualities of the environmental good being valued. It has been repeatedly found that WTP estimates for multiple improvement levels of environmental goods where one level of the improvement is a subset of the others do not differ significantly (Svedsäter 2000; Jorgensen et al. 2001; Whitehead et al. 2009).[5] In what is considered a landmark publication, Desvousges et. al. (1992) aim at the estimation of the WTP to protect 2,000, 20,000, and 200,000 migratory waterfowls from drowning in thousands of waste-oil holding ponds in Texas, Oklahoma, and New Mexico. Results show that WTP to protect the differing quantity of birds do not statistically differ. The detection of the embedding and part-whole bias spearheaded a huge wave of criticism of the CVM in the 1990s (Desvousges et al. 1993; Diamond and Hausman 1993; Diamond and Hausman 1994). They have also led to the development of a standardized scope test in CVM practice (Desvousges et al. 2012). In a scope test, a reduced or raised level of the environmental good is valued in a split survey design. The study is considered as passing the scope test when WTP for the two levels of provision are statistically different.

Now observations where practical WTP estimates are overly sensitive to the theoretically irrelevant factors are considered. This category includes biases associated with elicitation question formats such as starting point and range biases both of which have already been discussed in section 2.3.1. Here, what is known in the CVM literature as protest bid is discussed. In CVM studies, it is common that there be a group of respondents who refuse to contribute to the provision of the environmental good by stating zero WTP. These zero bids have two possible meanings depending on the underlying reasons of these respective respondents. In case respondents stated a zero WTP because they are in fact indifferent to or expect no utility gain from the provision of the environmental good, their zero WTP is considered as consistent with the economic theory of value and must be included into the benefit-cost analysis. Nonetheless, when the zero WTP are the respondents' expressions of protest beliefs,[6] these "protesting" zero

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[5] For counter examples, see Nielsen and Kjaer (2011), Bateman and Mawby (2004), Chilton and Hutchinson (2003), Norinder et al.(2001)

[6] Protest belief refers to protest attitudes associated with the process of valuation or the constructed market scenario (Meyerhoff and Liebe 2006).

WTP do not reflect the true economic preferences of respondents towards the proposed program and must be treated with extreme care.

The task for CVM studies is to eliminate potential biases that will be introduced by the protest zero. Unfortunately, there is neither a solid agreement about the procedure to distinguish genuine zero WTP from protest responses nor a procedure to treat protest responses in the survey dataset. To date, the method to identify protest zeros is to use of debriefing questions, i.e. attitudinal questions eliciting the underlying motivations of respondents for their WTP responses. Zero bidders who hold protest beliefs are identified as the protest zeros (Strazzera et al. 2003; Ferreira and Gallagher 2010). According to this criterion, the percentage of protest bids in a CVM survey can be as high as 80-90% (Ferreira and Gallagher 2010, p. 647). Recently, Meyerhoff and Liebe (2006) have argued that respondents who gave positive WTP may as well hold protest beliefs. A participant may have protest beliefs about the project scenario (e.g. he or she may think that the project cannot be realized as promised) but might still express a positive WTP. This raises a question of whether or not and to what extent the WTP stated by this person accurately reflects his or her preference toward the environmental good in question. As a result, researchers should not treat only protest beliefs of zero bidders but they should also pay attention to the protest beliefs of respondents stating positive WTP. After the typical biases encountered in CVM surveys have been introduced in this section, the next section will present the sources of such errors and biases.

2.4.2 Main sources of errors and biases of CVM results

This section attempts to highlight the points where a CVM survey can go wrong, producing WTP estimates that deviate from the theoretically correct ones. It should first be mentioned that this section confines itself to a fundamental aspect of the CVM, i.e. its role as an empirical measure of individual welfare. This means, biases related to methodological issues such as selection of a survey sample, estimation of the mean WTP, and aggregation of the WTP estimates are excluded from the consideration. Of course, these methodological issues contribute one way or another to the calculation of the social value of an environmental project. But they are not directly relevant to the validity of individual WTP responses given by households. Ahlheim et al. (2010) detected that in the course of a typical CVM interview there are three main sources of errors and biases of CVM results. These "Sources of Error" (SoE) occur in the course of the formation of individual WTP, the revelation of individual WTP, and the aggregation of individual WTP. As the third SoE is related to the aggregation of the WTP

estimates, only the first two SoE will be presented below (for the SoE associated with the aggregation process see Ahlheim et al. 2010).

The first source of error (SoE1) arises from the fact that it is extremely difficult for respondents in a CVM interview to derive a reliable estimate of their individual valuation of the project proposed. Typically, it is not the task of citizens to assign value to environmental goods. The decisions whether or not and to what extent an environmental good should be preserved or provided are usually made on a high political level. In the CVM, respondents are asked to make these decisions, which can be very difficult for them. Furthermore, forming an exact idea of the benefits to be expected from some environmental project that does not yet exist can be very difficult since such a project cannot be inspected and the knowledge about the project in question is usually limited to the information given in the questionnaire. In addition, respondents in a CVM interview are typically approached by an interviewer who requests them to make valuation decisions right away without any possibility to delay the decision. So, respondents are given only a limited time to process the information about the project proposed and to form expectations about its benefits for them. Within this short period of time, respondents have to read or listen to the description of the project, to imagine about the benefits of the program that typically has not yet been realized, and to formulate their overall expectations about the program. All these tasks require considerable mental effort which some respondents may not be willing to invest at the time of the interview.

The second source of error (SoE2) stems from the fact that respondents in a CVM interview may refuse to state what they have in mind as the true value of the project in question. A reason for such behavior might be the hypothetical nature of the CVM. WTP statements given by respondents in a CVM survey are only a statement of intention and have no immediate consequences. Respondents may give a WTP amount that differs from the true amount they would actually be prepared to give because of strategic reasons. They may misreport their WTP to influence the provision of the good and/or the final level of payment they have to make for the good (Bateman et al. 2002). These two types of responding are also known as overpledging and free riding (Mitchell and Carson 1989).[7] Other respondents may choose not to report their true WTP because of emotional reasons. They may feel upset with some statements in the questionnaire or with some behavior of the interviewer. As a consequence, they understate their

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[7] Overpledging refers to the situation where respondents state a WTP that is higher than their true WTP assuming that their answers will influence the decision about the provision of the good in question but at the same time they will not form any basis for the pricing policy. Free riding occurs if individuals understate their WTP answers while expecting that others would pay enough to ensure the provision of the good (Venkatachalam 2004).

WTP. Misreporting of WTP may also occur by chance and misunderstanding. For instance, respondents may be influenced by WTP elicitation question formats and give WTP statements that are not in accord with what they actually have in mind. For example, they may perceive the WTP bid in the DC question as an appropriate level of contribution and thus give a (distorted) WTP statement accordingly.

Figure 2-3 illustrates the course of a typical CVM interview and the two sources of errors of CVM results that have been discussed in this section (SoE 1 & SoE 2) are marked. After a description of an environmental project has been presented to the respondents, they have to process the given information in order to form an idea of the benefits from the project presented and of the individual welfare changes these benefits might lead to. More specifically, respondents have to think about the attributes of the project in question and its intended environmental changes. Respondents also have to imagine how the environmental changes would affect their well-being. As mentioned before, these mental tasks are not easy, and respondents may not be able to accomplish them completely. This can lead to wrong expectations regarding the project and as a consequence wrong estimates of the individual welfare changes. This is what referred to as the problem of value formation (SoE 1) and the resulting bias is for instance the part-whole bias (see 2.4.1). In the next step of a CVM interview, respondents are asked for their WTP. This is where respondents consider how to report their true WTP to the interviewer. Again, respondents may not state their answer in the way assumed by the CVM researcher. This is what referred to as the problem of value elicitation (SoE 2). Resulting biases are, for example, hypothetical bias, strategic bias, protest responses (see 2.4.1), and biases associated with elicitation question formats (see 2.3.1). After the problems of value formation and value elicitation have been discussed, the next section will review studies that aim at giving psychological explanation to these problems. The attempt to give psychological explanation of WTP response behavior represents the central research aspect of this study. Thus, it will be discussed in more detail in the following.

Figure 2-3: Sources of error in a CVM survey

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                    ┌─────────────────────────────────────────┐
                    │  Description of an environmental project │
                    └─────────────────────────────────────────┘
                                        │
                                        ▼
          ┌───────────────────────────────────────────┐      ┌──────────────────────────┐
          │         ╭───────────────────────────╮     │      │ Problems of value        │
          │         │  Processing of information │     │      │ formation                │
 ┌──────┐ │         ╰───────────────────────────╯     │      │  • Embedding and         │
 │ SoE 1│ │                     │                      │      │    part-whole bias       │
 └──────┘ │                     ▼                      │      │                          │
          │         ╭───────────────────────────╮     │      └──────────────────────────┘
          │         │  Formation of expectations │     │
          │         ╰───────────────────────────╯     │
          └───────────────────────────────────────────┘
                                        │
                                        ▼
                    ┌─────────────────────────────────────────┐
                    │  Benefits expected by the respondents    │
                    └─────────────────────────────────────────┘
                                        │
                                        ▼
          ┌───────────────────────────────────────────┐      ┌──────────────────────────┐
 ┌──────┐ │         ╭───────────────────────────╮     │      │ Problems of value        │
 │ SoE 2│ │         │  WTP elicitation question  │     │      │ elicitation              │
 └──────┘ │         ╰───────────────────────────╯     │      │  • Hypothetical bias     │
          └───────────────────────────────────────────┘      │  • Strategic bias        │
                                        │                     │  • Protest responses     │
                                        ▼                     │  • Starting point bias   │
                    ┌─────────────────────────────────────────┐      │  • Range bias            │
                    │              Stated WTP                  │      │  • Centering bias        │
                    └─────────────────────────────────────────┘      └──────────────────────────┘
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Source: Adapted from Ahlheim et al. (2010)

2.4.3 Sources of error of CVM results: The psychological perspective

Over the past years, CVM research has been witnessing an increasing number of studies aiming at an investigation of the psychological mechanisms of CVM response behavior (Fischer and Hanley 2007; Frör 2008; Ryan and Spash 2011; Börger 2013). A common characteristic of studies using this approach is that they conduct a direct investigation into the mental processes that lead to respondents' WTP statements. Their main aim is to investigate whether CVM respondents think and behave according to the assumptions of neoclassic economic theory. Early studies of this kind use simple and intuitive methods to examine the WTP decision making processes (e.g. Svedsäter 2003). Recent studies employ more specialized psychometric measures to make direct examinations of the latent characteristics of CVM respondents (e.g. Frör 2008). These two categories of studies will be introduced in turn.

Beginning with the studies that use simple measurement tools, the authors of these studies employed intuitive methods like debriefing questions (e.g. Svedsäter 2003) or qualitative research methods like the verbal protocol analysis (Clark et al. 2000; Chilton and Hutchinson 2003) to investigate what respondents were thinking when they were forming their expectations

about the proposed project and reporting their WTP answers. For instance, respondents are asked to "think aloud" by describing their thoughts when making WTP decisions. By these methods, researchers can examine reasons behind stated WTP of respondents. Results show that interviewees have consistent difficulties in understanding the valuation questions, but they nevertheless tend to answer the questions regardless of the meaning they attach to the tasks. It is also found that a huge portion of participants in contingent valuation surveys give stated WTP that are referenced by theoretically irrelevant motivations like charitable motivations and political issues. Similar outcomes are reported in a series of classic studies by Kahneman (1992; 1993; 1999). These studies show that WTP statements only represent the value of a feeling to have done something good, or of some "moral satisfaction," and not the economic value of the environmental good as assumed by economic theory. Kahneman demonstrates that WTP may only express the level of satisfaction an individual obtains from the "act of giving". Thus, stated WTP does not represent the utility an individual expects from the consumption of the environmental good in question but from the act of giving or at least stating the intention to give in the CVM interview. This phenomenon, that the act of giving generates a positive utility change of its own, is also known as the concept of "warm glow of giving" (Andreoni 1989; Andreoni 1990).

Special attention must be drawn to a number of studies that assess dispositional attributes of CVM participants using specialized measures designed and validated in psychology (Frör 2008; Börger 2013). These studies have a common assumption that all individuals possess certain inner attributes. By identifying these inner attributes of CVM respondents, one may be able to establish a direct link between these psychological attributes and various different patterns of CVM response behavior as predicted by theory. This will provide a better understanding of the respondents when answering WTP questions. It must be noted that studies employing this approach differ from other direct validity studies in that they utilize constructs that have been developed and validated in the field of psychology. Also important is the fact that they employ well-tested psychometric inventories to assess these constructs.

It was found that some respondents have psychological attributes that may contribute to the value formation problems occurred in CVM surveys. Frör (2008) utilizes a model developed in cognitive psychology to investigate the type of information processing CVM respondents use when answering WTP questions. According to the dual-process model of reasoning, there are two main reasoning processes that are operating in the human mind: analytical-rational and intuitive-experiential thinking styles. Intuitive-experiential persons tend to minimize their cognitive efforts in making decisions. They prefer to make their decisions by reference to

hunches, intuition, and feelings. Analytical-rational individuals, on the contrary, prefer to exercise full cognitive ability in decision making situations. It is very likely that intuitive-experiential respondents will not thoroughly consider all attributes of the proposed environmental project and assign value to the project based on only some of its attributes. Following the same line of argument, analytical-rational respondents who are more cautious in their valuation will be able to find the value of the project that is closer to their true value. Using a question inventory developed to assess the two information processing styles, Frör demonstrates that intuitive-experiential participants state significantly smaller WTP than analytical-rational respondents. This result supports his hypothesis that people with intuitive-experiential reasoning style may be susceptible to the value formation problems and thus their WTP statements should be interpreted with caution.

Apart from the psychological explanations of the value formation problems, those of the value elicitation problems were also found. Börger (2013) studies a form of response bias known as socially desirable responding (i.e. the tendency of respondents to give answers that make them look good) in the context of the CVM. The author argues that the socially desirably responding is motivated by the general desire of the respondent to gain social status, a person's disposition also known as the need for social approval. By employing a well-validated question inventory designed to measure the need for social approval of individuals in a CVM study conducted in Southwest China, the author is able to detect the different levels of individual propensities to strive for social approval and relate such tendencies to people's WTP statements according to theoretical predictions.

This section gave an overview on issues regarding the quality of welfare estimates obtained from the CVM. It highlighted two critical points where CVM might produce responses that deviate from the true WTP. The section also presented a number of irregularities and systematic distortions of WTP responses detected in the CVM literature. These include, e.g. the hypothetical bias, embedding, and protest bids. Eventually, this section introduced the attempts of CVM researchers to make investigations into the psychological processes underpinning WTP response behavior. They successfully demonstrate that, when coming up with their WTP response, CVM respondents may be thinking of purchasing moral satisfaction or of a contribution to a charity, and not of the expected utility from the proposed environmental program. Interviewees may not be able to understand the questions as initially intended by the researchers. More recently, a few studies have detected psychological attributes of respondents that are responsible for their inability to form correct expectation about the proposed project and for their intention to report desirable WTP statements instead of the truthful ones.

2.5 Summary

The aim of this chapter was to give an overview of the theory and practices of environmental valuation with a special focus on the contingent valuation method. The chapter starts with rationales for the economic valuation of environmental goods. It explains that the true value of the environment carries a very important piece of information, i.e. the level of welfare that the environment can create for human beings. But since this true value of the environment cannot be found by the mechanisms of the market, it has to be assessed by alternative environmental valuation approaches. Next, the chapter introduces the framework of total economic value of the environment and makes clear the many channels through which environmental goods can generate well-being to individuals and societies. Subsequently, the chapter presents a theoretical instrument that can be used to determine changes in well-being of individuals resulting from the public provision or conservation of environmental goods, i.e. the Hicksian Compensating Variation. The Hicksian Compensating Variation can be used without reservation in the comparative static welfare analysis including the measurement of individual welfare changes resulting from environmental projects. As the maximum amount of money that people are willing to pay in order to receive the benefits from some environmental project (WTP) can be interpreted as representing the Hicksian Compensating Variation, this theoretical welfare measure can be used in practical environmental valuation.

These practical valuation methods are introduced in the second part of this chapter. Two families of methods are presented, namely the indirect and direct valuation methods. The differences between the indirect valuation methods like the travel cost method and the hedonic pricing method on the one hand and the direct valuation methods like the CVM and the ABCM on the other are discussed. One decisive difference is that the direct valuation technique allows for the assessment of both use- and nonuse values. This property is one of the main reasons why the CVM plays a very important role in the context of environmental valuation. Therefore, the third part of this chapter delves into details of CVM interview and questionnaire design. In the section it becomes clear that there are many parts in the CVM protocol that can go wrong. Being a survey-based method, the CVM relies heavily on the questionnaire and on the direct statement of respondents regarding their welfare changes.

The quality of CVM surveys is discussed in the fourth section. Studies that examine the criterion, convergent, and theoretical validity of CVM surveys are reviewed. Findings from these studies suggest that the practical CVM surveys may sometimes produce welfare estimates that are not theoretically consistent with the true level of individual welfare changes. This is

because the two main sources of errors that tend to turn up in the course of practical CVM studies. Firstly, it is quite difficult for respondents to realize their true individual valuation in CVM surveys, and secondly, even if respondents are able to realize their true individual valuation, they might not be willing to report it to the interviewers. At the end of the fourth section, studies that investigate the psychological foundations of the two sources of error of practical CVM surveys are reviewed. Authors of these studies aim at a better understanding of the psychological processes within a respondent leading to biased statements of WTP. Findings show that psychological concepts can improve the understanding on many biases occurring in practical CVM studies. Therefore it seems justified to make a further investigation into this area. In the next chapter, personality psychology, which is one of the leading disciplines that investigates psychological characteristics of human beings, will be introduced.

Chapter 3 Personality

The purpose of this chapter is to introduce those concepts and tools developed within the field of personality psychology which can be used to analyze the task of stating a WTP for an environmental good in a CVM survey. The next section discusses the fundamentals behind personality psychology and makes clear why it is worth examining this sub-field of psychology, and where the focus of such an examination should be placed. Section 3.2.1 outlines the central concept in this field, i.e. personality, and will show that the concept of personality is holistically referred to as an entity which determines an individual's behavior. A number of theories have been proposed regarding its components, but at present the trait approach to personality is the most prominent. Within this approach, personality is defined and measured in terms of traits, meaning the fundamental human dispositions – those influencing people's typical behavior, thoughts and feelings. Section 3.2.1 ends with a discussion on the relevance of trait to the CVM. Trait measurement tools are then introduced in Section 3.2.2, after which Section 3.2.3 discusses the reality behind traits and the influence traits have on people's' behavior. Section 3.2.3 concludes that it is worth investigating personality psychology in general and trait theory in particular for three key reasons. First, traits are the psychological concept which is central to human behavior, second, traits can be conveniently measured using a self-reporting questionnaire, and third, it has been shown that traits can be used to explain people's behavior in many real world situations. Section 3.2.4 introduces the taxonomy of personality traits, the concept that results from psychologists' attempt to identify the fundamental traits of human beings.

Section 3.3 introduces the Big Five factor model (BFM) as a specific trait model which formed the conceptual basis of the empirical research carried out in this study. A short history of the BFM is given in Section 3.3.1. Section 3.3.2 introduces a specific BFM model, one developed by the two prominent psychologists Paul Costa and Robert McCrae, whose research on the BFM introduced the model to a wider audience. Descriptions of the five traits used in their model and the corresponding sub-traits are also given. It will become apparent from the discussions in this chapter that these concepts form a group of powerful dispositions, those able to explain the variety of psychological phenomena that exist within individuals and; thus, should be able to provide an insight into CVM response behavior. Section 3.3.3 presents the measurement tool used in the assessment of the BFM, with issues regarding validity in general

and cross-cultural validity in particular also discussed. A summary of the chapter is given in Section 3.4.

3.1 Fundamentals of personality psychology

3.1.1 Understanding the concept of personality

There has always been an interest in the latent characteristics of individuals[8], but the scientific investigation of such latent attributes has only been pioneered when the modern era of psychology began - in the 1930s or approximately 30 years after Sigmund Freud published his ground breaking book, *The Interpretation of Dreams*, and revolutionized the way people look at psychology. During that time, American studies of "individual differences" were integrated with the German studies into "Charakter", thereby producing a new psychological discipline: personality psychology (McAdams 2001). In the first issue of the *Journal of Personality* (then *Character and Personality*), McDougall (1932), an early pioneer of psychology, attempted to provide a clear-cut definition of personality from the very start. He argued that personality carries the same meaning as the German terms "Charakter" and "Persönlichkeit," it being "the sum total of those [internal] features, properties, or qualities of an individual organism…" (McDougall 1932, p.4). Although McDougall did not specify what those "features, properties, or qualities..." are, his definition of personality provides a good starting point when wishing to understand the concept, for it suggests that personality is a holistic concept.[9] Personality does not refer to fractions of people's mental attributes, as with concepts in other fields of psychology, such as emotional or cognitive attributes, but instead is meant to provide a greater level of understanding of a person's whole and intact characteristics.

In what is considered the first major textbook on personality psychology: *Personality: A Psychological Interpretation*, Gordon W. Allport (1937) also searched for a specific definition of personality, one that best represented contemporary psychological usage. Credited as the founding father of personality psychology, Allport viewed personality as a person's true inner identity, i.e. "what an individual is regardless of the manner in which other people perceive his

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[8] Interest in people's latent attributes can be traced back to the works of Aristotle and his student Theophrastus, both of whom felt that the behavior of individuals is determined by a certain inner "character" (Matthews et al. 2009, p.3).

[9] Holism is one of the distinguishing features of personality psychology, its view being that the workings of people's minds must be understood as a whole, and that they cannot be fully understood from the sum of their parts (McAdams 1997). This feature distinguishes personality psychology from other sub-disciplines of psychology which tend to be elementaristic (McAdams 1997, p. 4).

qualities or evaluate them" (Allport 1937, p.40). Like McDougall, Allport also perceived personality as being holistic, referring to it as "the total manifold psycho-physical individuality" (Allport 1937, p.24). To identify the specifics behind this, Allport reviewed in total 49 meanings of personality derived from the domains of psychology, philosophy, sociology, as well as theology (p. 29-46). His definition of personality, which is still quoted to this day, is that it is "the dynamic organization within the individual of those psycho-physical systems that determine his unique adjustments to his environment" (Allport 1937, p.48). Although this definition is more technical and more difficult to understand than McDougall's, it reveals three grand visions Allport had on the nature of personality at that time, those which would steer personality research for many decades to come.

First and foremost, this definition reveals that Allport saw personality as an entity that lies within individuals. This implies that the components of personality are not readily observable and thus they need to be conceptualized and verified. Second, Allport saw personality as a set of psychophysical systems. By "psychophysical systems" Allport meant that personality is neither exclusively mental nor exclusively neural. Personality "entails the operation of both body and mind, inextricably fused into a personal unity" (Allport 1937, p.48). Allport posited that "psychophysical systems" refers to all dispositional factors, all of which, he argued, can be described by traits. This attempt by Allport to explain the components of personality using trait notions was quickly followed by the proposal of alternatives by other contemporary psychologists. This subject of trait theory and its alternatives will be picked up again shortly. Third, personality has causal effects on behavior (Allport 1937, p. 48), contending that "personality *is* something and *does* something." According to him, personality is what lies behind "unique adjustments to [a person's] environment." By this, Allport meant that a personality is a person's survival kit. However in 1961, he changed this description to "characteristic behavior and thought" (McAdams 1997, p.4), and so broadened the influence of personality, extending it to cover its effects on people's consistencies in behavior and thought.

In sum, the personality construct was conceptualized as a result of a belief among personality theorists that the psychological individuality of human being should be holistically investigated. An important outcome is that the personality construct is a very broad monolithic concept. The most important work from the early days is from Gordon Allport who attempted to provide a clear-cut, yet still broad, definition of personality. In the following, attempts to better understand personality made by other theorists shall be reviewed. Two main research questions which were of interest to personality theorists after the publication of Allport's work were (i) what precisely are the systems which form the core of personality? and (ii) how can

they be measured? The first of these questions was asked during the period 1930 to 1950, and the second between 1950 and 1970 (McAdams 1997). This section addresses only question (i), while question (ii) will be the focus of section 3.1.2.

Which components constitute personality?

So, what systems form the core of personality? As mentioned above, this question characterized personality psychology during the period 1930 to 1950, a time when psychologists focused on the construction of the conceptual systems needed to understand personality (McAdams 1997, p. 7). Over time, theories have been developed by psychologists from various schools of thought, such as psychoanalytic theory, bio-psychological theory, behaviorist theory, cognitive theory and trait theory. These personality theories are also known as the "grand theories," because of the differing influences they receive from the classic schools of psychology (Runyan 1997). These grand theories are based on different epistemological assumptions regarding personality. At present, trait theory dominates the other theories and, therefore, will be introduced in greater detail. Other personality theories will only be briefly touched upon below.[10]

Psychoanalytic personality theory focuses on the role of the unconscious - a part of people's mind in which the mental activities take place without their awareness (McAdams 2001). The founder of this tradition, Sigmund Freud, believed that a great deal of an adult's personality is defined by the content of his or her unconscious, and this is why Freud believed that people are not able to understand why they are the way they are, and that the only way to learn about people's personalities is to make use of the specialized techniques developed by psychoanalysts, such as dream analysis. In sharp contrast to the psychoanalytic theories, behaviorist theory proposes that the determinants of personality lie outside a person. The basic proposition behind behaviorism is that personality can be best understood by investigating situational factors (McAdams 2001). Despite being a psychological discipline, behaviorism refuses to deal with any psychological entities which cannot be directly observed, like thoughts and feelings. To understand people's individuality, behaviorism investigates the situational determinants only, and so bypasses all psychological phenomena. Other approaches focus on the inner qualities of individuals as the core of personality. For example, cognitive theory contends that subjective thought lies at the center of individuals' personalities (Pervin and Cervone 2010), so what characterizes people are their own thoughts, such as how they perceive

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[10] For more detail on these theories, the reader should consult Pervin and Cervone (2010) and McAdams (2001)

themselves and how they perceive the world around them. To learn about people's personalities, we have to investigate their personal perceptions. The bio-psychological approach, meanwhile, focuses on the role of genes, hormones and neurotransmitters. According to this approach, personality is inherited and can be changed only if the genes, hormones and neurotransmitters are altered (Pervin and Cervone 2010).

The above overview of personality approaches reveals an obvious disagreement among them as to what forms the core of personality. Some argue that it is the unconscious which lies in the center of the workings of personality, while others contend that it is situational factors, subjective thoughts or biological characteristics. This is not surprising, after all, personality is a construct devised in order to take an accurate account of the whole, coherent and intact mental characteristics of a person - a tall order in itself, and the complexities of the constructs would seem to be a natural outcome of this. As a result, it is often mentioned that the different aspects of personality are so diverse that they can never be united within any single theory (e.g. Ryckman 2008), and that what personality theories describe is only a fraction of the truth behind the workings of a personality (e.g. Carducci 2009).

Trait: The building block of personality

It was mentioned before that there is another approach to the study of personality – the trait approach. Allport developed trait theory because he foresaw problems regarding the complexity of the concept of personality; that the phenomena encompassed by human personality are too complex and diverse to be workable, especially within empirical studies. As a result, he suggested that the concept of personality should be "broken down" into smaller units, those suitable for the purposes of description and measurement, i.e. traits (Allport 1937, p.236). So, a trait can be best understood as the basic structural unit or building block of personality. At present, personality is usually defined and measured in terms of traits (Hofstee 1994)[11], and therefore the trait approach to personality will be discussed in more detail than will other approaches.

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[11] Trait theory started to dominate the personality study landscape when personality theorists diverted their attention from building conceptual systems to engaging in the empirical investigation of personality, i.e. during the period 1950 to 1970 (cf. McAdams 1997, p.13). What personality scientists needed during that time was a way to operationalize personality concepts so that the field could be moved forward by empirical investigation. The primary focus of the field became the identification and measurement of the constructs that tap the key components of personality. Such practices were expected to increase our level of understanding regarding the different parts of personality, which later could be put back together to create better theories of the whole (McAdams 1997, p.15).

Trait theory is simple, and it roots lie in everyday common sense. Every day, we employ the trait approach when we characterize ourselves, our colleagues or relatives - using various trait descriptors. We are familiar with trait descriptors like "outgoing," "imaginative," "worrying," "trusting," and "organized," for we use these terms every day. These trait terms are believed to be meaningful because they can explain and predict people's behavior in many situations. At the very least, the fact that people exhibit enduring behavior over time and across situations seems to confirm the existence of traits; however, no one has ever directly observed traits – they may only be words used for the classification of habits or they may have an objective reality. Traits are probably meaningful, but we do not know their true nature. Allport built trait theory based upon this common usage of and belief in traits.

Allport agreed that traits provide us with an easy, natural and meaningful way to account for people's individuality (Allport 1937); however, he added that traits are more than just words used to organize categories of behavior. Traits are an objective reality and are the foundation of people's enduring behavior; they have the ability to energize, direct, and select behavior. Furthermore, Allport believed that traits have a biological basis and are also based on the neuropsychic structure of a given person (Allport 1961). Allport's notion that traits have a biological basis has been maintained and further explored by many contemporary trait scientists (Gray 1982; Eysenck and Eysenck 1985; Zuckerman 1991; DeYoung et al. 2005), and the dominant scholars in this field are Hans J. Eysenck and Jeffrey Gray, who developed biological explanations for traits that have become very well established in trait psychology. These models are known as Eysenck's theory of arousal and Gray's Reinforcement Sensitivity Theory (for an excellent review of both theories see Matthews and Gilliland 1999).

Yet, the majority of contemporary trait theorists resist making generalizations about the nature of traits (e.g. McCrae and Costa 2006; Hogan 2007). They believe that traits are an objective reality and do not deny their psycho-physiological foundations. However, they believe that additional factors may have roles in determining traits. It is generally conceived that traits have a diverse nature (McAdams 2001), and may be collectively determined by the unconscious, by genetics, the surrounding environment and individual cognition. It may also be the case that different traits have different origins; that while some traits may be determined by the unconscious or by individual subjectivity, other traits may be inherited (McCrae and Costa 2006). Consequently, contemporary trait theorists left the nature of traits open, focusing instead on three major aspects of personality traits (for a more comprehensive review see Matthews et al. 2009 and McAdams 2001).

Firstly, traits are generally seen as dispositions within individuals that are somewhat stable across time and across different situations. Traits are like the "unchangeable spots of the leopard" (Matthews et al. 2009, p.3). This means that if a person has a strong trait of, say, friendliness, it must be possible to find evidence that that person is consistently friendly in a variety of situations. The stability of a trait is an important assumption on which trait theory is based. If a trait does change depending on the situation at hand, it is not a meaningful concept. Secondly, traits are typically considered as a continuum ranging from one extreme to the other extreme. This implies that traits are comparable among individuals, analogous to human weight or height. All personality traits are possessed by all individuals, however to different degrees. Lastly, most theorists maintain that traits exert a significant influence on behavior. This means that traits causally influence, and therefore are able to explain, individual tendencies (c.f. McAdam 2001, p.255)[12]. Consequently, contemporary trait theorists generally refer to traits as *dimensions of individual differences that contribute to an individual's enduring patterns of feeling, thinking, and behaving* (e.g. McCrae and Costa 2006, p. 25; Pervin and Cervone 2010, p.228; Wilt et al. 2011, p.987).

Related to the main topic of this dissertation, based on the review conducted in this section, in the real world respondents in a CVM survey must be expected to possess a collection of dispositional traits which are somewhat stable over time and across situations. These dispositional traits are the "unchangeable spots of the leopard" and define respondents' "true characters." It is also to be expected that all CVM respondents possess the same set of dispositional traits only to a different degree. Furthermore, it can be expected that traits hold an important role in respondents' functioning and are instrumental in causing behavior to occur overtime and in different situations including in the CVM survey. All these suggest that if we are able to identify traits within CVM respondents, we can gain a better understanding on their response behavior, such as when they are answering WTP questions. Clearly, for the concept of traits to be useful for the CVM, suitable assessment techniques must be available. In the next section, methods used for the assessment of traits during the course of a CVM survey will be discussed. On the one hand, the method of inquiry used must be valid and reliable, while on the other, it must be comprehensive enough to assess the personalities of CVM respondents in a very short period of time.

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[12] Alternatively, some theorists maintain that traits are only convenient categories which can be used to describe consistent behavior. Traits do not *cause* behavior. According to this view, the trait of friendliness does not cause a person to be friendly. It only describes the person's tendency to behave in a friendly manner overtime and across different situations (McAdams, 2001, p.254).

3.1.2 Measuring traits

Regardless of how psychologists theorize the nature of personality and traits we should never forget that traits are a psychological construct, meaning personality and traits are postulated attributes and cannot be directly observed in the same way as objects in the physical world. Constructs do not possess physical properties and cannot be measured in terms of objective magnitude, as can tables or cups - their properties are strictly theoretical. It goes without saying that the theoretical conceptualization of a construct determines the tools used to measure it. Different grand personality theories advocate the use of different types of investigation methods to understand personality; for example, psychoanalytic theorists state that personality is characterized by the content of people's unconscious, and as a result, they recommend the use of specific psychoanalytic practices such as dream analysis to explore it (Freud 1913). As the focus of this study is on trait theory, particular attention will be paid to the investigation methods it uses, while for details of the methods used within the "non-trait" approach, readers should consult Pervin and Cervone (2010).

Trait psychologists use personality inventories such as questionnaires to measure single or multiple traits at the same time. During the years 1950 to 1970, when personality psychologists started to focus their attention on the empirical investigation of personality (see previous section), trait concepts were rigorously translated into specific procedures, those capable of being measured and described in empirical terms. Special attention was paid to the development and refinement of self-administered personality inventories, as apparatuses to be used for the assessment of personality traits in a normal population[13] (McAdams 1997). Self-reporting inventories make use of the direct questioning to elicit people's trait attributes, and respondents in such surveys play the role of the observer of their own personal characteristics - reporting them to researchers by answering questions contained within the specific inventory. Of course, respondents are not asked "do you have the 'deliberation' trait?," but are asked to rate the extent to which their behavior, thoughts or feelings correspond to a series of statements. These statements reflect nothing but differing aspects of the trait construct in question. Statements representing the trait deliberation include; for example, "I think things through before coming to a decision", and "I plan ahead carefully when I go on a trip" (Costa and McCrae 1992b, p.74). The usual answer format with these personality inventories is in the form

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[13] During that time, the Minnesota Multiphasic Personality Inventory (MMPI) (Hathaway and McKinley 1940) was the most popular self-reporting inventory used. Nonetheless, its use is specific to people with emotional disorders. Its forerunner, known as the first modern personality test, was Woodworth's Personal Data Sheet, which was developed by Robert Woodworth in 1919 (McAdams 1997, p.7). This test was developed to assist the United States Army identify recruits who may be prone to combat stress.

of a Likert scale (Likert 1932), as these allow respondents to express the extent (e.g. frequency, intensity or strength) to which statements reflect their behavior. Within a 5-point Likert scale, the potential answers are "very frequently," "frequently," "occasionally," "rarely," and "never." The scores for each scale range from 5 (very frequently) to 1 (never). People who score highly on these statements also receive high trait scores. The interpretation made from such a scoring method is clear: high scorers on a trait behave, think and feel in particular ways more often and more intensely than low scorers.

The fact that traits can be assessed using a personality inventory is very useful when using the CVM, for in order to learn about respondents' latent attributes, minimal instruments are required, and those questions designed to assess the attributes of interest can be conveniently integrated into a CVM questionnaire. This implies that the personalities of respondents can be appraised in all survey modes, such as face-to-face interviews, mail surveys and internet surveys. The use of personality inventories also implies that CVM researchers will be able to assess the personality traits of a considerable number of respondents within a short period of time, and as most personality inventories are multiple-choice tests, the interpretation of their scores will also be straightforward and can be carried out by CVM researchers who have no educational background in psychology. Other assessment techniques, in which answers may be given in terms of verbal statements, may not have this advantage, such as dream interpretation. As the use of direct questioning to assess personality traits is useful when using the CVM, and so could be employed during this study, its strengths and limitations should be presented in more detail.

The strength of self-reporting questionnaires lies in their intuitiveness, for most question items are statements related to everyday activities. In order to provide valid answers, i.e. statements that truly reflect the underlying traits in question, respondents only have to think about the frequency and intensity of certain behavior or feelings they exhibit or experience over time and in different situations, and this is a simple task. Furthermore, it is clear that no other person has access to the traits of a particular person, so asking a person about his or her own personality characteristics can be considered the most direct method possible.

The limitations of self-reporting questionnaires lie in their two key assumptions, first, that people know enough about themselves to give meaningful statements regarding their traits, and two, that they will give honest answers to researchers (Murray et al. 2008). These assumptions represent the Achilles' heel of self-reporting questionnaires, and so will be considered in turn here. Beginning with the first assumption, it is argued that a person may not know everything about him or herself (Kagen 1988; Kagen 2005; Kagen 2007), an issue best illustrated using the

Johari window (Luft 1969), which is named after Joe Luft and Harry Ingram. The Johari window (see Figure 3-1) helps people understand different aspects of their own personality. The box named "public area" describes the aspects of personality that are known to an individual and to others, while the "blind area" refers to the personality dimensions not known to an individual, but that are obvious to other. Aspects of personality that are unknown to both the individual and others are shown as existing within the "area of unconscious" box. Eventually, the "hidden area" subsumes the areas of individuality known to the person, but unknown to the others.

Figure 3-1: The Johari Window

	Known to self	**Unknown to self**
Known to others	Public area	Blind area
Unknown to others	Hidden area	Area of unconscious

Source: Luft (1969)

It is clear that self-reporting tools do not have access to those personal attributes not known to the individual using them, i.e. the blind area and the unconscious area, and this is one of the reasons why other measurement tools like observer-rated questionnaires and projective tests have been devised. Observer-rated inventories claim to be able to assess the blind area of individual personality. In an observer-rated questionnaire, questions are written in the third person so that relatives, spouses, close friends or colleagues can give their own ratings. The basic elements of the other ratings are the same as those of the self-rated tools. Projective tests have been claimed to be able to capture the unconscious traits of individuals (Entwistle 1972). In a projective test, participants are asked to respond to ambiguous stimuli (e.g. inkblots or vague photographs). Since the meanings of such stimuli are unclear, there are infinite ways to interpret them. An individual's unconscious is believed to be projected through his or her responses (interpreting the given stimuli) in the projective test session.

Using the self-reporting questionnaire, one can only measure traits that are known to the person, though this seems reasonable, because no convincing evidence exists either way regarding the "unconscious" and "blind" traits. For example, for the unconscious traits, there are still doubts regarding the validity and reliability of their measurement tools and so much more research needs to be conducted (Johnson 1997), while blind traits are not as important as

they first appear. Studies that correlate the observer- and self-rated personality scores often report a satisfactory level of correlation, i.e. between 0.40 and 0.60 (McCrae et al. 2004; Connolly et al. 2007). In other words, the information obtained using the self-rated and observer-rated tools tend to be the same.

The second assumption used by self-reporting inventories is that respondents will report truthfully to researchers, and this represents another weak point in this measurement tool. The reason for this is that individuals may be reluctant to report their own traits. When answering personality questions, survey respondents have two options; they can choose to disclose their true characteristics to the interviewer, or they can withhold the truth about themselves, meaning they may not be willing to report all their traits as they actually perceive them - they may present themselves as they believe others would like to perceive them. This problem is known as 'socially desirable' responding, meaning the "tendency to give answers that make respondents look good" (Paulhus 1991, p.17). Although the problem at hand is quite clear - that socially desirable responding can affect the outcomes of self-administered personality assessments - the solution is not, in fact this issue has been examined for decades and no satisfactory solutions found. This is because it is in fact very difficult to detect if and to what extent individuals respond to personality questionnaires in a socially desirable manner.

Typically, the detection of socially desirable responses relies on the use of self-reporting questionnaires, such as the Marlowe-Crowne Social Desirability Scale and the Balanced Inventory of Desirable Responding (Paulhus 2002). The basic principles behind these self-reporting tools are similar; they contain a list of desirable but uncommon characteristics, and also undesirable but common characteristics. Claiming to have desirable attributes or denying the presence of undesirable ones are both signs of untruthful responses. High scorers have a greater tendency to give socially desirable responses than low scorers. Personality measures are considered to be biased by socially desirable responses if the scores from the two measures correlate. In a landmark publication, McCrae and Costa (1983) argued that the use of correlation as evidence of the invalidity of personality measures is unjustified, as the social desirability scales do not only measure the tendency to give overly (and therefore untrue) positive self-descriptions but also the truly positive self-descriptions of individuals. Individuals who in fact have all the desirable characteristics listed in the social desirability scales would also obtain a high social desirability score. And consequently the correlation of the social desirability scales with personality measures will indicate shared substantive variance, and not shared artifact.

In summary, the use of self-reporting questionnaires is an appropriate way to elicit personality traits, for two main reasons. First, it is the most intuitive and direct method to use

for measuring latent attributes like traits, and second, self-reporting offers a number of empirical advantages for researchers. Despite some limitations to the method, self-reporting questionnaires still offer the most effective way to measure individual traits, and particularly in the context of this study. Now that both trait concepts and their measurement have been introduced, the next question to consider is: How useful are trait concepts in the real world?

3.1.3 Traits in practice: Objective reality and influences on behavior

The central question for this section to address is: Are traits of use in practice and to what extent? This is an important question because, after all, traits are hypothetical constructs, so neither their existence nor their impacts on behavior should be taken for granted. One further question arises from this: How can a postulated attribute such as a trait and its influence be verified in the real world? Guidelines for the validation of theoretical constructs like traits were developed during the 1950s[14], with important contributions being: *Technical Recommendations for Psychological Tests and Diagnostic Techniques* – as collated by the American Psychological Association (1954), Cronbach and Meehl (1955), and Loevinger (1957), which together detailed the fundamental principles behind construct validation. According to Cronbach and Meehl (1955), a construct exists only as an "open concept," which is defined implicitly using a "network of laws." This network of laws may refer to the relationships between the construct under consideration and other constructs, or the links between the construct in question and observable variables. When the construct under consideration is fairly new, it may be defined only by a few associations. Over time, the "network of laws" defining a given construct will be enriched by means of dynamic processes through which the network is further defined and elaborated as new empirical findings accumulate over time. It should be noted that the validation of a psychological construct resembles general scientific procedures used for developing and testing theories. The point to be made here is that traits are also an open concept, so we can only validate the workings and existence of traits by subjecting them to the relevant network of laws, that is, their relationship to other constructs and/or observable variables.

What does the evidence say regarding the reality of traits and their influence on people's behavior? These very same questions were at the center of the "person-situation" debate that

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[14] Before that, psychologists were occupying themselves with criterion-oriented validity tests (Cronbach and Meehl 1955, p. 281ff.). The procedure used in these tests is simple. Test administrators conduct the measurement, obtain independent criteria, and compute the level of correlation between the test results and the selected criteria. An intelligence test; for example, is valid when its scores are correlated with criteria such as GPA records.

characterized the development of both personality psychology and social psychology over two decades - the 1970s and 1980s. The person-situation debate was ignited by Walter Mischel's *Personality and Assessment,* published in 1968, the main message of which was that human behavior is too inconsistent to make traits a meaningful construct (Mischel 1968; Mischel 1973). Mischel argued that individual behavior is determined by different situations, and; therefore, tends to vary across them. He stressed that behavior is highly situation specific, so personality traits cannot be applied to predict human behavior. The critique produced by Mischel became influential because of his convincing empirical evidence demonstrating that people tend to act in a manner inconsistent with their traits. He showed that people's trait scores and their actual behavior do not usually correlate; and when they do, the correlation is generally weak - a correlation figure of 0.30 has been used as the upper boundary of the relationship between personality traits and behavior for some time. Mischel further argued that the inconsistent nature of human beings implies that there is no such thing as a trait disposition as suggested by trait psychologists.

Such harsh critiques offered by Mischel prompted trait psychologists to engage in two lines of research the first of which attempts to demonstrate that traits do exist as an "objective," psychological attribute (Block 1977; McCrae and Costa 1987; Costa and McCrae 1988). The second line of research tries to show that trait-behavior correlation is, in fact, stronger than the presumed level of 0.30 (Epstein 1979; Epstein 1983; Epstein and O'Brien 1985). These two lines of research will be briefly reviewed in turn.

Following the first line of inquiry, proponents of trait psychology tested the existence of traits using either cross-observer or longitudinal studies. The rationale behind using cross-observer studies was that if traits are an objective reality, they must be "perceivable", not only to the person in question, but also to others, such as parents, spouses, relatives, close friends and colleagues. The cross-observer validity of personality traits can be assessed when respondents are each rated by at least two observers - one of whom may be the subject. The rationale behind longitudinal research is that if there are such things as traits, they should be manifested in terms of the relative stability of individuals' trait scores. This is because traits are relatively enduring characteristics among individuals. Traits must endure across situations and over time, otherwise one would not be able to distinguish traits from mental states. The typical method used in longitudinal studies is to administer the same personality inventory to the same person twice, with the duration between the two tests ranging from a number of weeks to a few years.

Evidence suggests that satisfactory levels of convergence exist between self- and observer-rated personality tests (McCrae 1982; McCrae and Costa 1987); for example, McCrae and Costa (1987) administered the self- and observer-rated versions of two different trait instruments. In their study, the subjects were asked to nominate friends, neighbors and co-workers who were not their relatives, and the results showed substantial levels of agreement among different observers regarding the traits of the same subject. Agreement was also found between self-raters and peer-raters. The magnitude of the correlations ranged from 0.40 to 0.60, and the results held for both personality inventories. These results led authors to point to the existence of traits as objective psychological attributes, those that both groups of respondents could perceive somewhat accurately. The results were confirmed recently (Connolly et al. 2007).

Evidence from longitudinal studies has also showed that traits are somewhat stable overtime. Some longitudinal studies have suggested that traits exhibit their robustness over rather long periods of time, such as six years (Costa and McCrae 1988) or in some studies, 45 years (Soldz and Vaillant 1999). What makes things complicated for this form of inquiry is the perception of trait psychologists that individual traits are only *relatively* stable (Costa and McCrae 1997) - trait theorists do not expect individuals' trait scores to remain stable throughout their lives. In fact, personality scientists believe that there are normative trait patterns that shift within individuals. For this reason, results from longitudinal studies cannot be meaningfully interpreted unless the normative shift among traits is revealed. Researchers have put significant effort into investigating the normative shifts among traits, and early evidence presented by McCrae and Costa (1994) suggested that after the age 30, individual traits become more stable. This proposal was widely accepted among trait psychologists until recently, when new evidence emerged showing that traits do change even in people over 30 years of age, and that patterns of personality development are unique for each person (Roberts and Mroczek 2008). Basically, this means that much more research is needed, and that the nature of trait development is far from settled. Until this research is carried out, evidence from longitudinal studies may provide only weak support for the objective reality of trait.

As to the second line of inquiry that attempt to investigate the predictive power of traits, evidence on trait-behavior correlations suggests that traits can predict behavior better than the 0.30 barrier mentioned previously. The average degree of correlation between a single trait and a behavior has been updated to around 0.40 (Nisbett 1980), which is already very close to the theoretically obtainable level of correlation between a specific trait and a specific behavior of 0.50 (Ahadi and Diener 1989; Strube 1991). Interestingly enough, the effect of a given

"situation" on behavior is not stronger than that of a "person." In a special issue of the *Journal of Research in Personality* (2009 – issue 43), published to commemorate 40 years of the person-situation debate, Funder (2009, p.120) noted that 0.40 represents about the same impact level as documented over a century of social-psychological research (Richard et al. 2003). Worse, some authors pointed out that while the "person" side of the debate can be defined with considerable specificity and validity, the issue of how to specify and measure "situations" is far from settled (Hogan 2009). Thus, the prediction of single behavioral acts cannot be expected to depend upon explanations drawn from a single situational variable.

In sum, traits seem to be a useful psychological concept in the real world. Driven by the critique on trait theory which were put forward during the 1970s, personality psychologists have since convincingly demonstrated that the concept of traits exists as objective psychological attributes and that traits do have a significant impact upon people's behavior. Taken section 3.1.1, 3.1.2 and 3.1.3 together, it appears that the concept of personality in general and traits in particular, provides an appropriate conceptual basis for the investigation of the psychological characteristics of CVM respondents. First, traits hold an important role in the functioning of individuals, i.e. they give rise to behavior. Second, traits can be conveniently measured during a CVM survey through the use of personality inventories, and third, empirical evidence supports the assertion that traits exist as objective attributions and can be used to predict people's behavior. For these reasons, the use of trait theory in this study would appear to have been justified.

3.1.4 Trait taxonomy: In search of the fundamental traits of human beings

In the remainder of this section, the focus will shift to the selection of those traits to be used to explain WTP response behavior. The key question related to this was: Which traits should be selected for analysis in the context of a CVM survey? Trait selection is a crucial step in such a study, and lessons had been learned from consumer studies conducted during the 1970s and 1980s (Kassarjian 1971; Kassarjian and Sheffet 1981; Kassarjian and Sheffet 1991), a time when traits were used rigorously to predict the purchasing-decisions of consumers. Contrary to expectations, traits showed a poor predictive ability with regard to the consumption choices of economic agents (Kassarjian 1971), one of the many reasons for this being the lack of theoretical justification for the investigations. In most cases, "no *a priori* thought is directed to how or why personality should or should not be related to that aspects of consumer behavior being studied" (Jacoby 1971, p. 244). In addition, it was often the case that the personality scales used were not appropriate, with trait concepts developed to explain such issues as psychological

condition such as schizophrenia being used to predict the purchasing behavior related to washing machines or a pair of shoes.

To avoid repeating these mistakes, this study employed those traits which represent the most crucial aspects of an individual personality, as this ensured that the selected dispositions would be critical in helping to understand the psychological "pillars" that underlie the way in which people function across contexts and over time. But what are the most important aspects of an individual personality? It was discussed earlier that the early personality theorists were not able to answer this question, and their attempts to gain a more comprehensive level of understanding of personality led to the conclusion that the phenomena embedded in this concept is too diverse and complex to be united in any single theory. As a result, personality theorists went elementaristic, focusing their interest on conceptualizing and measuring parts of personality, such as traits (see 3.1.1). And as will be shown below, this shift in focus was followed by the development of a multitude of traits, and this ultimately led to a resurgence of interest in the carrying out of research aimed at developing a comprehensive theory of personality.

The resurgence of interest to develop a comprehensive theory of personality was triggered by the need to bring order to a discipline which had been flooded with trait descriptors (see John et al. 1988). Due to the boom in interest around trait research, the number of trait descriptors developed "escalated without an end in sight" (John and Srivastava 2001, p.102). The number of traits identified ended up being as high as between 2,800 and 4,500, depending on the definition of a trait used (Allport and Odbert 1936; Norman 1967). For this reason, trait scientists attempted to identify a set of fundamental personality descriptions in terms of trait taxonomy. The basic idea behind trait taxonomy is that the universe of personality dimensions is influenced and therefore can be represented by a limited number of essential personality traits (John and Srivastava 2001). Obviously, a taxonomical approach to traits is a theoretical breakthrough that should be exploited in this study, for it not only facilitates the selection of those traits to be used, but will also ensure that all the key mental attributes held by individuals are taken into account.

Apart from the three key assumptions of trait theory reviewed in section 3.1.1, trait taxonomy relies on one additional key assumption. The assumption is that all trait terms can be organized into some kind of hierarchical structure, implying that there are different levels of traits - from more general to more specific ones. Traits at the lower level of the hierarchy are assumed to contain meanings that are both common and specific. Based on their common meaning, the lower level traits can be combined to form a larger but more general trait.

However, this also means that some specific meanings around the smaller traits remain unexplained by the larger or global ones. By measuring specific traits, additional information over and above that which could be obtained from the global traits is guaranteed.

Over the years, various trait taxonomies have been proposed (Cattell 1947; Eysenck 1947; Costa and McCrae 1992a), but nowadays it seems to be commonly accepted in personality psychology that there are five core psychological aspects of human beings, and that they are represented by five global personality traits, or the "Big Five" (Goldberg 1993). Despite some controversy (Eysenck 1992; McAdams 1992; Block 1995), the Big Five Personality Model (or BFM; also known as the 'five-factor theory' or 'five-factor model') has gained traction among personality psychologists as a general taxonomy of personality traits (De Raad 2000). Since 1995, the BFM has outpaced alternative trait taxonomies and dominated publications on personality studies (John et al. 2008). It is the intention of this study to employ the BFM, for it is expected that by identifying the five psychological pillars of CVM respondents, it will be possible to give sound psychological explanations for many of the participants' WTP responses, those left unexplained by micro-economic theory.

Even though the use of the BFM to explain an economic valuation of environmental changes has yet to be tested, two reasons exist which would lead one to believe that the BFM will provide a valuable theoretical foundation for this study. First, the BFM contains key personality dimensions that are important when wishing to understand individuals. As will be shown later in this chapter, these core personality dimensions cover various psychological areas, including the emotional, interpersonal, experiential, attitudinal and motivational aspects of people, all of which may play a decisive role in their WTP decisions. Second, the BFM is well validated, for even though there are varying taxonomical models, only the BFM has been accepted as a common language among personality psychologists. Over the last few decades, its validity and reliability have been intensively evaluated. Throughout the remainder of this chapter, the conceptualizations and measurement of the BFM will be introduced and discussed.

3.2 The Big Five personality model (BFM)

This section is designed to introduce the conceptualizations and definitions of the five global traits and is structured as follows. Section 3.2.1 offers a short history of the BFM, introducing how personality psychologists came to a consensus that the basic structure behind personality differences could be analyzed using only five global traits. As this section unveils, it is apparent that two lines of inquiry have played a major role in helping to uncover the thousands of trait

descriptions that exist and which can be broadly categorized into the five dimensions. These lines of inquiry are associated with the so-called lexical and questionnaire tradition. While Section 3.2.1 focuses on the former, Section 3.2.2 takes a closer look at the questionnaire tradition. The five-factor model developed by Paul T. Costa, Jr. and Robert R. McCrae will also be introduced, for their work associated with the questionnaire tradition forms a line of research that has had a tremendous influence on the development of the theory-based BFM. At present, Costa and McCrae's framework is the most used within the field of personality studies, and; therefore, will be adopted in this study. Also in Section 3.2.2, each of the five global traits will be placed under the microscope, before Section 3.2.3 discusses measurement of the Big Five and also the applicability of the BFM in non-English speaking countries.

3.2.1 A short history: Why five?

To properly understand the development of the BFM, the concept of lexical hypothesis must be introduced. The lexical hypothesis was pioneered by Gordon Allport, in an attempt to identify all trait descriptions that exist in the personality sphere. Allport postulated that all important descriptions regarding human behavior can be explored in everyday language. The basic assumption behind this hypothesis is that those individual differences that are most salient and socially relevant in people's lives will eventually become encoded into their language; the more important such an individual difference, the more likely is it to become expressed as a single word (John et al. 1988). The study by Allport and Odbert (1936) marked one of the first scientific studies on trait taxonomy to be carried out using lexical hypothesis. [15] They pioneered the lexical hypothesis by selecting trait terms from the second edition of the unabridged *Webster's New International Dictionary*. All nouns and adjectives that could be used to "distinguish the behavior of one human being from that of another" were investigated (Allport and Odbert 1936, p.24). They compiled a list of approximately 17,953 words and put these into different categories, these being: personality traits, temporary states, evaluative judgments and doubtful terms. Allport managed to obtain 4,504 words that could also be classified as trait terms.

Allport's identification of the "trait sphere" served as the basis for an important breakthrough in taxonomical research made by Raymond B. Cattell (1943). Cattell believed that there are different levels of trait description, from the most specific traits to the most

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[15] The first lexical study was completed by Baumgarten (1933), who assembled terms from various German dictionaries and publications using her own judgment, but did not classify the terms further (John et al. 1988, p.176).

general. This idea drove him to engage in a quest to condense the list of trait terms making use of the factor analytical method, which is a statistical method that had recently been developed. This method can be used to detect the underlying but unobservable structure of a dataset. Using factor analysis, the inter-correlations among general traits can be detected, and their "sources" identified. There were two main steps in Cattell's attempt to extract the source traits. First, Cattell (1943) used the semantic reduction process, in which he omitted terms with prefixes for which the stem terms were also available. As a part of this, he excluded many rare, archaic and colloquial terms (De Raad 2000). The remaining terms were categorized on the basis of both synonymity and anonymity, producing bipolar trait descriptions. This first step resulted in 160 categories of trait descriptions, and then by adding terminology that had been developed by psychologists, Cattell arrived at 171 personality variables, those he claimed comprised the complete personality sphere. Second, Cattell used correlation analysis to find the "sources" of these 171 traits, and the result was the 35 derived personality variables. Cattell argued that these 35 traits represented source traits, later applying oblique factor analysis and obtaining 12 personality factors which later became a part of his 16 personality factors, also known as the 16-PF.

Cattell's 16-PF triggered the discovery of the BFM. Empirical studies that tried to replicate Cattell's study failed to uncover the 16 personality factors (Fiske 1949; Tupes and Christal 1961; Norman 1963; Digman and Takemoto-Chock 1981), but instead found that the structure of people's personality could be best described using only five personality variables and not 16 as suggested by Cattell. The BFM was "discovered" when Donald Fiske (1949) executed factor analysis based on peer- and staff-ratings from 128 subjects. He found that people's personality is best described using only five dimensions. Fiske did not follow-up on his initial findings and his discovery is often described as an "accident" (Goldberg 1993, p.27). Years later, Tupes and Christal (1961) attempted to clarify these factors, carrying out factor analysis studies based on peer ratings from 790 subjects. They also re-analyzed Cattell's datasets as well as those of Fiske. Their results replicated Fiske's, i.e. the persisting structure of the Big Five was found across all different sample groups. Tupes and Christal described the five factors as: emotional stability (calm and not easily upset), surgency *(*talkative, assertive and energetic*)*, culture (intellectual/cultured and independent-minded), agreeableness (good-natured, cooperative and trustful*),* and dependability (conscientious, responsibility and orderly). Their five factors resemble the first five in Cattell's 16 PF and show striking similarities to Fiske's 5 (John et al. 1988). Other scholars who investigated Cattell's framework and obtained

the five personality dimensions are, among others, Norman (1963), and Digman and Takemoto-Chock (1981).

One limitation of these pioneering studies is that they are all rooted in Cattell's personality model; therefore, what the evidence from these studies really shows is that Cattell's 35 personalities can be summarized within five broad personality traits. In addition, researchers were convinced that Allport and Odbert's analyses were hindered by technical limitations (Goldberg 1993), and this led to the idea that a "second round" of dictionary studies and of factor analyses should be conducted in order to confirm the BFM. This task was carried out mainly by two prominent personality researchers - Warren Norman and Lewis Goldberg. During the 1980s and 1990s Goldberg worked extensively on English words, then newly identified by Norman (1967)[16], as the full universe of trait descriptions. From Norman's complete set of 2,797 trait terms Goldberg (1981) constructed his trait inventory, excluding terms whose meanings could not be well understood and words that were variants of the already included terms (John et al. 1988). This led to the development of an inventory of 1,710 traits, and this inventory was used as a basic tool to scrutinize Norman's trait sphere. Goldberg executed a series of studies unearthing trait dimensions that he believed best represent the basic structure of Norman's trait terms. The studies were summarized in Goldberg (1990). The factor structures of personality data in these studies clearly replicate the BFM, and Goldberg eventually concluded that the five personality traits best account for the basic structure of individual personality. As a result, he dubbed these five global traits, the "Big Five."

To sum up, the BFM was originally "discovered" as a result of the many waves of investigation into English language trait terms. With help from the factor analytical method, the theoretical significance of trait terms in the English dictionary, and the idea of there being a hierarchical structure of personality, was empirically exhibited. The BFM has since been validated to the extent that it forms an important milestone in personality research, bringing a consensus to the field of personality psychology that humans' latent and stable psychological

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[16] Norman (1967) scanned the unabridged 1961 Webster's Third New International Dictionary (the version used by Allport and Odbert in 1936 which was issued in 1925). He found 9,046 terms in addition to Allport and Odbert (1936), most of which were either suffixal or prefixal variations of terms already included. He therefore added only 171 terms, resulting in a master set of 18,125 terms (cf. John et al. 1988, p.185). From these, Norman derived 2,797 terms that can be used to describe consistent and stable modes of individual adjustment to the environment. His 2,797 trait terms are much fewer in number than Allport and Odbert's 4,504, because he excluded dispositions related to physical and mental health (e.g. insane) and physical dispositions (e.g. athletic) (cf. John et al. 1988, p.187). Norman's listing provided the foundation for most contemporary taxonomies, because the exclusion and inclusion of terms was based on much more explicit criteria.

attributes can be comprehensively described using the five most fundamental aspects of an individual personality.[17]

As to environmental valuation research, the BFM forms a sound starting point for any investigation into the effects of traits on WTP response behavior. Table 3-1 shows the labels used for the five dimensions given by different investigators. Minute variations of the content across studies have been noted. Tupes and Christal's work represents the first wave of studies to discover the five dimensions, while Goldberg's work took place as part of the second wave, during which the Big Five was confirmed. Costa and McCrae's model, meanwhile, represents the modern conceptualization of the BFM. In the next section, their definition of the Big Five, which has been left untouched until now, will be discussed in more detail.

Table 3-1: Different descriptions of the five personality dimensions

Tupes and Christal (1961)	Goldberg (1981)	Costa and McCrae (1992)
Emotional stability	Emotional stability	Neuroticism
Surgency	Surgency	Extraversion
Culture	Intellect	Openness to experience
Agreeableness	Agreeableness	Agreeableness
Dependability	Conscientiousness	Conscientiousness

Source: Adapted from John et al. (2008)

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[17] Still, the degree of consensus around the BFM should by no means be over-romanticized. Some scholars did suggest that the basic structure of personality is constituted of more/less than five dimensions. Some contend that not five but seven (Simms 2007), three (Eysenck 1990), two (Blackburn et al. 2004, Gray 1970), or even one factor (Musek 2007) are the basic traits. However, unless these alternative models are supported by empirical evidence, it is difficult to evaluate their validity and reliability, or whether or not they better represent the landscape of an individual personality than the BFM.

3.2.2 Costa and McCrae's framework

Because the BFM was developed from trait terms contained within an English dictionary, some psychologists said that the Big Five should be interpreted as descriptive rather than explanatory concepts (John et al. 2008), meaning that predictions regarding individuals' behavior could be made based on the five global traits. However, these domains are not necessarily the causes of people's behavior due to their lexical origin. For example, a statement such as "Bob works hard *because* Bob is conscientious" is a circular statement.[18]

A different conceptualization of the Big Five was put forward by Paul T. Costa Jr. and Robert R. McCrae, who proposed that the Big Five are basic dispositions that "contribute causally to the development of habits, attitudes, skills, and other characteristic adaptations" (McCrae and Costa 1995, p.231). The underlying mechanisms of such influences are left open, meaning "the mechanisms through which traits operate may or may not be specified in psychological theory" (McCrae and Costa 1995, p.248). According to this perspective, "Bob works hard *because* Bob is conscientious" can be considered a genuine explanation; however, the true mechanisms - referring mostly to biological ones (John et al. 2008) - underlying the causal influences of "conscientiousness" on "working hard" remain to be discovered.

The reason for these varying conceptualizations lies in the fact that Costa and McCrae's BFM was developed using a different approach from the lexical one (McCrae 1994). The BFM based on a lexical hypothesis begins from the bottom-up: firstly identifying all traits in the personality sphere using information from natural language in the dictionary, and then identifying the broadest possible dimensions that could describe those traits. Costa and McCrae began at the top and worked down, meaning first the broadest possible dimensions of traits were identified and only then their constituents (Costa and McCrae 1992b). Rather than investigating traits in a dictionary, Costa and McCrae chose to work with questionnaires whose scales were designed to measure constructs derived from personality theories. The guiding principle of Costa and McCrae's work is to search for resemblances in what various questionnaire scales measure. By identifying as many as possible of the broad personality traits that are common across theories and questionnaires, and at the same time searching for the broad traits that are left unaccounted for, by the late 1980s Costa and McCrae were convinced that they had exhausted the full range of personality characteristics (McCrae and John 1992).

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[18] An alternative view given by Johnson (1997, p.77) was that such a statement can be considered a valid explanation, even if the Big Five are only a description of typical behavior and have no causal influence on them. The actual message from such a statement is that Bob's behavior is *not unusual* for him and; thus' his action requires no further explanations. It is similar to saying "that's typical" or "that's in his nature."

Most importantly, McCrae and Costa were among the first to show that the Big Five constructed from lexical studies (the dictionary-based Big Five) converge with those derived from personality theory, i.e. the questionnaire tradition (McCrae and Costa 1985; McCrae and Costa 1987). They named the latter the Five-Factor personality model to distinguish it from the Big Five model.[19] In one of their classic papers, McCrae and Costa (1987) asked individuals to rate Goldberg's trait scales (an inventory designed to assess the dictionary-based traits of individuals) and the NEO inventory, which is a questionnaire developed by McCrae and Costa to assess theoretically based global traits.[20] The detail of this inventory will be given in section 3.2.3. After factor-analyzing the data, five factors were "revealed" across the datasets, so McCrae and Costa (1987) went on with the investigation, administering self-reporting and observer-rated versions of Goldberg's trait scales and the NEO inventory. Observers in the study were friends, neighbors and co-workers of the respondents, and the results showed that different observers agreed on the traits for the same respondent. Further, correspondences between self-rated and other-rated surveys were also reported. The results obtained led McCrae and Costa to conclude that the Big Five are objective, psychological attributes. The correspondences between the lexical BFM and the theoretically-developed BFM on the one hand, and between the self-reporting and other-ratings on the other, have very important consequences for the conceptualizations of the Big Five, showing that the five global traits are more than everyday English trait terms and that they have an objective reality as other, traditional trait concepts. This finding led to "a dramatic change in the acceptance of the five factors in the field" (John et al. 2008, p.139).

Basically, the Costa and McCrae five personality factor model and the lexical Big Five concept are similar. The number of dimensions in both models is the same, and the content of the dimensions are similar (Goldberg 1993). The main difference is that Costa and McCrae (1992b) conceptualize the Big Five in terms of domains and facets (see Figure 3-2), with domains referring to the five global personality traits, and facets referring to specific traits located at a lower level of the trait hierarchy. Each of the five domains is represented by six facets, not because each is naturally divided into six parts, but because literature suggests that at least six components are necessary to capture the workings of each domain (Costa et al. 1991). This approach has an important strength over the lexical tradition, because facets are

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[19] For convenience purposes, the five-factor model will also be referred to as the BFM for the remainder of this paper.

[20] NEO is an acronym for neuroticism, extraversion, and openness to experience the first three global traits that were identified by McCrae and Costa.

suggested by personality theories rather than the factor loadings of English trait terms (McCrae 1994). As a result, facets are traits in their own right, and they have theoretical foundations.

Figure 3-2: The Big Five model: Domains and facets
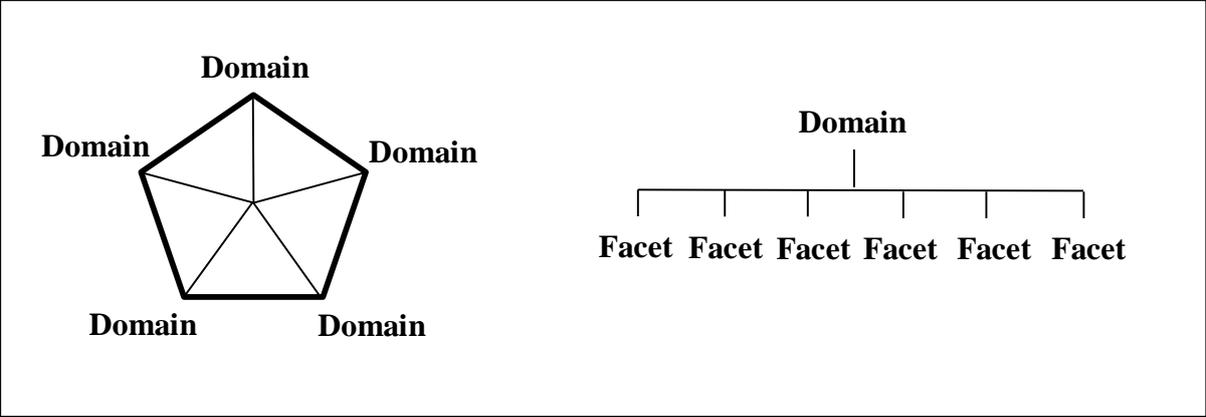
The BFM developed by Costa and McCrae formed the conceptual foundation for the empirical investigation into the psychological processes leading to WTP statements in this study. The reason for this lies in the decisive advantage of this framework, in particular its clear structuring of the facets underlying each personality domain. In the context of this study, these facets will help us to speculate and understand the many specific influences the five broad domains can have upon the CVM response behavior. Costa and McCrae's conceptions of the Big Five are introduced below, and the rest of this section is organized into five sections, each named after the five domains. At the beginning of each of these sections, the early conceptions (from the lexical and questionnaire traditions) of the domain will be presented, followed by those of Costa and McCrae.

Neuroticism

In personality studies that distill English trait terms, it has been repeatedly found that one of the five core aspects of individual differences deals with the tendency to experience negative emotions (Fiske 1949; Tupes and Christal 1961; Norman 1963; Digman and Takemoto-Chock 1981). People who possess a high level of this domain tend to experience negative emotions more often and more intensely than people who possess a low level. This personality factor is described using English trait terms such as *worrying*, *easily upset* and *emotional* at one end of the scale, and *emotionally stable*, *calm*, *placid* and *tough* at the other. This personality factor has been variously labeled as *emotional control*, *emotional stability* and *emotionality* (Fiske 1949; Tupes and Christal 1961; Norman 1963).

In traditional personality studies, traits describing the tendency to experience negative emotions have also been at the forefront thanks to the intensive research carried out by Hans J. Eysenck (1947). Eysenck's view of neuroticism resembles that of the lexical tradition, for he perceived neuroticism as a trait that determines the propensity of individuals to experience negative emotions. Individuals with a high level of neuroticism are receptive to stressful situations, while low scorers are calm and relaxed. Conventional wisdom on neuroticism was very much influenced by Eysenck's hypothesis; that neuroticism is associated with the brain's "limbic system,[21]" which at that time was believed to be an "emotional hub" in the human brain. Though considered obsolete by trait theorists today, Eysenck's hypothesis of the biological foundation of neuroticism paved the way for other brain-based theories of neuroticism to be developed. Eysenck's research on neuroticism played a very important role in convincing personality theorists, including Costa and McCrae, that neuroticism is one of the basic human personality dimensions (Eysenck 1947; Eysenck 1967; Eysenck 1990).

Costa and McCrae (1992b, p.14) view neuroticism as a personality domain that influences "the general tendency to experience negative effects such as fear, sadness, embarrassment, anger, guilt, and disgust." People with a high level of neuroticism have a high propensity to experience these six negative emotions. The neuroticism domain also gives rise to phenomena such as a susceptibility to impulses and a low ability to cope with individual stress (Costa and McCrae 1992b). Despite the similarities neuroticism may share with certain other mental disorders, Costa and McCrae stressed that neuroticism does not imply mental distress. Individuals can have a high level of neuroticism without having any mental disorders of any kind, while people with a low level of neuroticism are not necessarily cheerful or jolly the whole time – though they experience negative moods less often than high scorers. They tend to be emotionally stable, calm and even-tempered; relaxed and able to cope with stressful situations. It was mentioned before that Costa and McCrae conceptualized each of the five personality domains to encompass six specific traits or facets. In this study, facets will be used, not only to provide a better understanding of the working of these domains, but also to explain WTP response behavior. For now, descriptions for the facets of neuroticism are described in Box 3-1.

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[21] Note that the limbic system refers to a set of brain structures consisting of parts of the amygdale, septum, hippocampus and prefrontal cortex. The term may wrongly remind the reader of a different medical term - the lymph, which refers to a type of fluid in the body.

Box 3-1: Facets of neuroticism

Anxiety is a trait disposition that determines a person's tendency to be "fearful, prone to worry, nervous, tense, and jittery" (Costa and McCrae 1992, p.16). People with a high level of this facet experience the above mentioned feelings more often and intensely than others. Note that the trait anxiety deals with general fears, and does not refer to specific types of phobia. Individuals with a lower level of neuroticism tend to be calm and relaxed; they do not worry about things that might go wrong.

Angry-hostility refers to a trait that deals with "the tendency to experience anger and related states such as frustration and bitterness" (Costa and McCrae 1992, p.16). Whether anger and its related states are expressed by individuals depends, however, upon the level of their agreeableness domain (Costa and McCrae 1992). In contrast, individuals who possess only a low level of this trait are easy-going and slow to experience anger

Depression is a personal disposition that governs a person's tendency to "experience depressive affect" (Costa and McCrae 1992, p.16). Individuals who possess a high level of the trait depression are prone to feelings such as sadness, hopelessness and loneliness. This, however, does not imply that people who have a lower level of this trait are more cheerful or high-spirited, for these are in fact attributes associated with extraversion. What it actually means is that people with a low level of depression rarely experience a depressive mood.

Self-consciousness – this facet is linked to "the feelings of shame and embarrassment" (Costa and McCrae 1992, p.16). Self-conscious individuals are easily upset by ridicule, because they are prone to feeling inferior. People with a low level of this trait do not necessarily have good social skills, however, they are not easily troubled by awkward social situations.

Impulsiveness was initially perceived as a component of extraversion, however, it was then removed from that construct (McAdams 2001, p.310). Costa and McCrae included impulsiveness as a facet of neuroticism because impulsiveness leads to feelings of guilt, which is a negative emotion. This facet refers to "the inability to control cravings and urges" (Costa and McCrae, 1992, p.16). Desires are perceived as being so strong that people cannot resist them, although they may later regret the behavior. Costa and McCrae (1992) stated that impulsiveness should not be confused with spontaneity, risk-taking, or rapid decision-making,

which are a manifestation of (a lack of) the trait conscientiousness. People who have a low level of the trait impulsiveness are those who have no problem controlling their urges and desires.

Vulnerability is a personal attribute which is responsible for a "vulnerability to stress" (Costa and McCrae 1992, p.16). Individuals who possess a high level of this trait cannot cope with stress - they become "dependent, hopeless, or panicked when facing emergency situations" (Costa and McCrae 1992, p.16). On the other hand, people who have a low level of this disposition feel more in control.

Source: Costa and McCrae (1992b)

In a CVM survey, where respondents have to think about emotions that they will experience in the future (i.e. their level of welfare changes resulting from the proposed project), negative emotions that they experience at the time they are thinking about such future emotion could have an important influence. For a long time, psychologists have differentiated between emotions that people expect to experience as a consequence of the decision at hand (i.e. expected or anticipated emotions) and emotions that are experienced at the time of decision making, i.e. immediate emotions (e.g. Loewenstein 2000). Immediate emotions arise from factors that are irrelevant to the present judgments (e.g. emotions triggered by enduring personal dispositions like neuroticism) and thus they can distort the decision making of individuals (Loewenstein and Lerner 2003). Figure 3-3 illustrates the influence of immediate and expected emotions on decision makings.

Figure 3-3: Expected and immediate emotions in decision makings
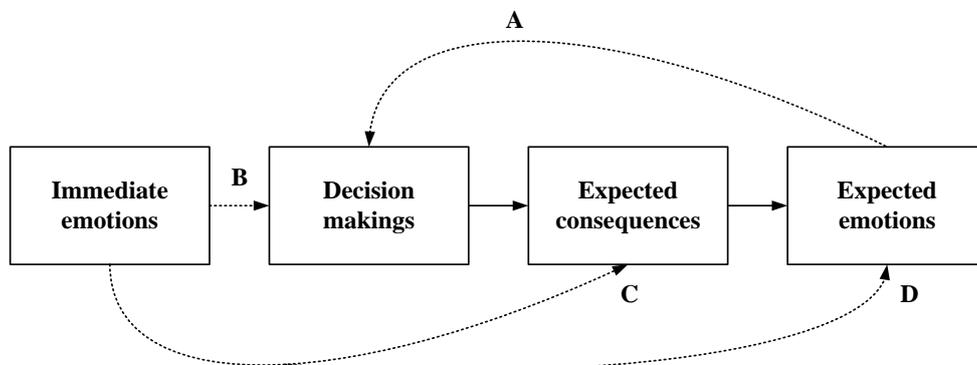
Source: Adapted from Loewenstein and Lerner 2003

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To make a decision, individuals have to imagine about the "expected consequences," i.e. all possible outcomes of the decision, and "expected emotions," i.e. how they would feel under each of these decision consequences. Individuals then make their decisions based on the expected emotions (depicted by line A). The influences of immediate emotions are illustrated by line B, C, and D. Line B depicts the situation where people rely on their present feelings in a heuristic fashion to make choices (Raghunathan and Pham 1999; Raghunathan et al. 2006). According to this affect-as-information approach, individuals try to extract information from their feelings (e.g. what their feelings mean for the issue at hand) and use it to form decisions (Raghunathan et al. 2006). Think about the case where people interpret their feelings of sadness and/or loneliness to mean that something good is missing in their lives and decide to purchase expensive items for themselves. Lines C and D illustrate the indirect impacts of immediate emotions. Immediate emotions alter how people view the likelihood of different decision outcomes (line C). These phenomena are generally known as mood congruency, i.e. people's perceptions on the future can be altered by their present moods (Mayer 1986; Mayer et al. 1992). Immediate emotions also influence how people will feel about those outcomes (line D). They can distort people's evaluations of the desirability of their choices – the effect known as hot-cold empathy gap (Loewenstein and Lerner 2003). Not illustrated in Figure 3-3 but also important is the effect of immediate emotions on depth of information processing (Loewenstein and Lerner 2003). Certain immediate emotions motivate systematic information processing while others give rise to more heuristic processing. Due to the reasons mentioned above, immediate emotions are often viewed as "disturbances," preventing individuals from realizing the true expected emotions.

In the context of the CVM, after considering the environmental change scenario, respondents have to think about all the possible outcomes of the project and also how they would feel as a result of these outcomes. Respondents then make their WTP decisions based on these considerations. As presented above, immediate emotions respondents experience during the time they make WTP decisions can have various disturbance effects. The disturbance effects of different facets of neuroticism on WTP decisions will be scrutinized in more detail in the next chapter.

Extraversion

In personality studies associated with the lexical approach (e.g. Tupes and Christal 1961; Norman 1963), another personality factor that constantly emerged out of factor analyses represents sociability and energeticness. This personality factor is characterized by English trait

terms like *talkative, energetic, sociable, cheerful, expressive* and *assertive* at the one end, and *silent, self-contained, solemn, secretive, submissive* and *cautious* at the other. This factor is sometimes referred to as *surgency* (e.g. Tupes and Christal 1961).

In traditional personality studies, theorists have long dealt with extraversion-introversion, whose meaning resembles that of surgency (Wilt and Revelle 2009). Extraversion-introversion was conceptualized by a protégé of Sigmund Freud - Carl Jung (1913/1971), and according to him, extraverts are people who direct their mental energy towards objects or people in the outside world, while introverts direct their energy toward the inner self. Nevertheless, Jung never performed any scientific work to test his hypotheses, and in the end it was Hans Eysenck who performed factor analysis, and found extraversion-introversion to be an important domain in terms of helping to understand individual differences (Eysenck 1947). He described extraverts as sociable and enthusiastic, and introverts as quiet and reserved, and established the arousal hypothesis of extraversion, which provides an in-depth understanding of the domain (Eysenck 1967). He proposed that neurological activity in the brain is an important factor in determining the individual level of extraversion-introversion. Based on the assumption of *Homo Staesis*, i.e. human beings are driven to maintain an optimum level of stimulation intakes, Eysenck suggested that extraverts are people who have a higher optimal level of stimulation intake than introverts, and because of this, extraverts constantly need more stimulation than introverts. Introverts, on the other hand, tend to be over-aroused because of their low optimal level of stimulation intake, so are more reserved. They attempt to reduce, rather than increase, the level of stimulation experienced from without.

Costa and McCrae's extraversion reflects Eysenck's work, and that of lexical studies. According to Costa and McCrae (1992b), the core meanings of extraversion deal with individuals' levels of sociability, energeticness and positive emotions. First, extraverts, or people who score high on the extraversion domain, prefer interpersonal interactions - are sociable people who favor social events. Second, extraverts are energetic, active and prefer excitements - they can also be described as upbeat, energetic and optimistic. Third, extraversion concerns people's tendency to experience positive emotions, so high scorers on the extraversion scale are inclined to feel good, are high spirited and optimistic. Low extraversion scorers, or introverts, are reserved yet not unfriendly people, but prefer to be alone. Introverts are not necessarily unhappy or pessimistic. Costa and McCrae (1992) conceptualized extraversion as subsuming six smaller traits, namely *warmth*, *gregariousness*, *assertiveness*, *activity*, *excitement-seeking* and *positive emotions*. The descriptions of these facets are shown in Box 3-2.

Box 3-2: Facets of extraversion

Warmth is a personality facet that deals with interpersonal intimacy. People who possess a high level of this trait are "affectionate and friendly" (Costa and McCrae 1992, p.17). They genuinely like people and have the ability to form close relationships with them. Individuals who possess a low level of warmth are not necessarily hostile - they are simply more reserved in their manner.

Gregariousness refers to "the preference for other people's company" (Costa and McCrae 1992, p.17). A person with a high level of this facet prefers to be surrounded by people, and the more the better. An individual who possesses a low level of this personality trait does not seek and may often avoid social stimulation. He or she tends to be a loner.

Assertiveness represents an aspect of extraversion that is associated with a person's tendency to be "dominant, forceful, and socially ascendant" (Costa and McCrae 1992, p.17). People who possess a high level of assertiveness often become group leaders. In contrast, individuals with a low level of assertiveness prefer to be in the background when it comes to social interactions.

Activity deals with a person's preference for action. More specifically, people with a high level of this trait are energetic and have a need to keep busy - often leading to a fast-paced life. People who possess a low level of this trait are relaxed; however, they are not necessarily lazy.

Excitement-seeking is a personality facet which means that individuals "crave excitement and stimulation" (Costa and McCrae 1992, p.17). Individuals with a high level of this personality trait love thrills, prefer things like bright colors and noisy environments. Individuals who possess a low level of this facet have little or no need for outside stimulation.

Positive emotions deals with people's "tendency to experience positive emotions such as joy, happiness, love, and excitement" (Costa and McCrae 1992, p.17). Positive individuals are optimistic, high-spirited, as well as joyful. In contrast, those who possess a low level of the positive emotion facet are not necessarily unhappy - they are simply less exuberant.

Source: Costa and McCrae (1992)

In contrast to what is commonly understood by laymen, extraversion does not deal only with sociability – the domain has multiple, core meanings. Other than sociability, extraversion also determines people's need for stimulation in terms of activities and excitement. On top of that,

extraversion is associated with a propensity to experience a wide range of positive emotions. Further investigations have been made into what the common features underpinning all these sub-components of extraversion are, and conclusions have varied. Some have concluded that it is the tendency to experience positive emotions (e.g. Watson and Clark 1997), while others state that it is a sensitivity to rewards (Lucas et al. 2000). However, the latest finding on this issue has suggested that at the core of extraversion is a tendency to engage and enjoy social attention (Ashton et al. 2002). Consequently, it is reasonable to suspect that, in the context of CVM surveys, the tendency to enjoy social attention of CVM respondents could play important roles in determining how respondents will state their WTP answers to interviewers. The theoretical link between extraversion and stated WTP will be analyzed in more detail in the next chapter.

Openness to experience

Since its inception, this personality factor has been characterized by disagreement; both in terms of its basic structure and also its naming convention (McCrae 1994). In lexical personality studies, *Openness to experience* has been labeled, either as *intellect,* because of the dominance of cognitive ability within the factor (Fiske 1949), or as *culture,* due to the dominance of a personal tendency to enjoy the arts and sciences (Norman 1963). It was Digman and Takemoto-Chock (1981, p. 155) who first argued that this personality factor should be characterized by both aspects - "one having to do with intelligence and the other with matters of culture." Goldberg (1990) agreed on this duality, and found that one of the Big Five is described by terms representing intellectual ability (*wisdom*, *knowledge*, *intelligence*, *depth*, *insight* and *curiosity*) and aesthetic preference (*sophistication*, *creativity* and *art*).

McCrae (1994) agreed that mere aspects of intellect do not cover the whole meaning of this personality factor, so he suggested personality psychologists use the term "openness to experience." McCrae's argument consisted of two main points. First, the main feature of this factor is in fact intellectual "interest" rather than intellectual "ability." Though the domain is shown to be correlated to individuals' cognitive ability, it is not its key element (McCrae 1994, p.254), so using the term "intellect" may be misleading. Second, McCrae (1994, p.254) argued that intellect "fails to suggest the diverse psychological correlates that the factor is known to have." He further argued that this personality factor is a wide concept which implies individuals' intellectual curiosity as well as broad interests, having a liberal view, adventurous tendencies and a need for variety. Only some aspects of intellect are considered to lie inside the central meaning of openness to experience.

Costa and McCrae (1992, p.17) stated that that openness to experience represents "the aspect or area of experience to which the individual is open." Such aspects and areas are represented by six facets: *fantasy*, *aesthetics*, *feelings*, *actions*, *values* and *ideas*. These facets are described in Box 3-3. In general, individuals with a high level of openness to experience are open for both emotional and intellectual experiences, and of the former, open individuals are both receptive and attentive to their own feelings. They are also people who have aesthetic sensitivity, so are highly responsive to beauty in various forms. Furthermore, such people enjoy imagining. As to the intellectual side, people with a high level of openness to experience have intellectual curiosity, are independent of traditions and values, and so prefer novelty and variety. People who possess a low level of openness to experience tend to have a narrower scope and intensity of interests; they tend to be conventional and conservative - preferring the familiar to the novel.

Box 3-3: Facets of openness to experience

Fantasy refers to the tendency of individuals to have an "active imagination" (Costa and McCrae 1992, p.15). People with a high level of this trait are keen on imagining and on further elaborating such fantasy to create for themselves interesting thoughts. They perceive imagination as being an important part of a creative life. In contrast, individuals who possess a low level of this personality trait tend to avoid fantasizing. Mind-wandering is for them something to be avoided and is not enjoyed.

Aesthetics is a personality facet that deals with a deep appreciation of beauty in various forms. People with a high score on this personality trait are those who have a true interest in the arts, music, and poetry. They are also people who are more receptive to aesthetic feelings, are easily absorbed in music, moved by art and intrigued in poetry. Individuals with a low level of this facet are uninterested in these aspects of life.

Feelings is a facet which implies a "receptivity to one's own inner feelings and the evaluation of emotion as an important part of life" (Costa and McCrae 1992, p.17). People with a high level of this facet have rich emotional experiences in terms of both their intensity and variety. Moreover, such people are keen to evaluating their own feelings, as generated in different settings and by different stimuli. Individuals who possess a low level of this trait do not place importance on the evaluation of their emotions.

Actions indicates a person's willingness to try new activities. People who possess a high level of this trait tend to enjoy novelty, enjoy going to new places, eating new food and trying new things. Individuals who score low on this trait prefer routine and familiarity over novelty. They find change difficult.

Ideas as a facet indicates both "an active pursuit of intellectual interests...[and a] willingness to consider new perhaps unconventional ideas" (Costa and McCrae 1992, p.17). Individuals with a high score on ideas tend to enjoy a wide variety of intellectual challenges and activities, enjoy cultivating knowledge and new ideas. However, low scorers have a limited number of interests and focus those interests on limited topics.

Values deals with people's "readiness to examine social, political, and religious values" (Costa and McCrae 1992, p.17). People who possess a high level of this trait prefer the dynamic nature of values - they believe that all values should be altered to reflect a changing society. In contrast, people with a low level of this facet believe that values should have a more static nature, tend to honor tradition and, thus, are inclined to be more conservative.

Source: Costa and McCrae (1992b)

To sum up all this, the personality domain of openness to experience addresses the experiential aspect of individual characteristics. The domain is manifested in the willingness of a person to expand his or her experience to encompass a wide array of feelings and thoughts. This individual characteristic could prove to be important in the contingent valuation surveys where participants are asked to make valuation decisions that require a lot of mental efforts. Respondents' internal desire to entertain new ideas or challenging cognitive tasks could play a pivotal role in determining how carefully and thoroughly they would think about the environmental improvement scenario to be valued. The theoretical and empirical links between the openness to experience and its facets on the one hand and the WTP response behavior on the other hand will be dealt with in more detail in the following chapters.

Agreeableness

In personality studies associated with the lexical hypothesis, one of the five personality factors is described using terms such as *good-natured*, *soft-hearted*, *self-effacing* and *readiness to cooperate* at the one end, and by *egoistic*, *self-willed* and *spiteful* at the other. This personality

factor was called *conformity* by Fiske (1949), *agreeableness* by Norman (1963) and *friendly compliance* by Digman and Takemoto-Chock (1981). A study examining Norman's trait terms reported that one of the Big Five subsumes trait terms like *cooperation*, *generosity* and *modesty* on its positive continuum, and *distrust*, *selfishness* and *rudeness* on its negative continuum (Goldberg 1990). Goldberg named this factor *agreeableness*.

According to Costa and McCrae (1992), the core meaning of agreeableness concerns social attitudes and the philosophy of life of individuals. People with a high level of agreeableness are fundamentally altruistic. They have sympathy for other people and so are eager to help them. However, altruism is not the sole aspect of agreeableness; the domain also subsumes personal attributes that determine how individuals perceive and deal with other people. Basically, agreeable people have a positive point of view towards the innate nature of human beings, and they deal with others based on this perception. Agreeable people are straightforward, humble and tend to make compromises on behalf of others. People with a low level of agreeableness are more skeptical of other people's intentions and tend to be competitive rather than cooperative. Furthermore, they are more ready to manipulate other people in order to accomplish their personal goals. Costa and McCrae proposed the basic facet structure of agreeableness as constituting *trust*, *straightforwardness*, *altruism*, *compliance*, *modesty* and *tender-mindedness*.

Box 3-4: Facets of agreeableness

Trust is a facet of agreeableness that deals with "the tendency to attribute benevolent intent to others" (Costa and McCrae 1992, p. 17). Individuals with a high level of this facet tend to believe that others are honest and trustworthy. In contrast, people who possess a low level of this facet tend to be cynical and skeptical; they are inclined to suspect others of being dishonest or dangerous.

Straightforwardness determines the directness with which people deal with others. Individuals who have a high level of this trait are frank and sincere, while someone with a lower level of straightforwardness is familiar with flattery and deception. He or she is more ready to "stretch the truth or to be guarded in expressing his or her true feelings" (Costa and McCrae 1992, p.17).

Altruism refers to "selflessness and active concern for others" (Costa et al. 1991, p.888). People with altruism characteristically have an active concern for other people's welfare, and are willing to help them at cost to themselves. This facet implies self-sacrifice, for altruistic

individuals are generous and willing to help others. Low altruism scorers are self-centered, and so are more reluctant to help others or become involved in other people's problems.

Compliance is an aspect of personality that deals with interpersonal conflict. People with a high level of compliance tend to forgive and forget - they tend to inhibit aggression and defer to others. They also prefer cooperation rather than competition. Low scorers have no problem with expressing their anger.

Modesty is a facet that reflects on aspects of an individual's self. Individuals with a high level of this trait are humble and modest; they are not preoccupied with themselves. However, they are not necessarily lacking in self-confidence. People that have a low level of modesty have an inflated view of themselves.

Tender-mindedness represents people's "attitudes of sympathy and concern for others" (Costa and McCrae 1992b, p. 18). Individuals with a high level of this trait have a "tendency to be guided by feelings, especially those of sympathy, in making judgments and forming attitudes" (Costa et al. 1991, p.889). People who have a low level of this trait tend to make decisions based on cold logic.

Source: Costa and McCrae (1992b)

To sum up, agreeableness addresses the interpersonal aspect of individual characteristics. It incorporates the qualities of empathy, friendliness, cooperation, and care. People with a high level of agreeableness are good-natured and soft-hearted. In easy words, agreeable people are nice people. When it comes to the contingent valuation surveys where individuals are asked to pay for some environmental improvement program which would generate benefit not only to the contributors but also to the society as a whole as well as to future generations, the qualities incorporated in the domain of agreeableness could play important roles in determining people's contribution decisions to the environmental improvement program in question. The conceptual links between the facets of agreeableness and stated WTP will be scrutinized in more detail in chapter 4.

Conscientiousness

In lexical studies, one of the five personality factors is labeled as *will to achieve*, *responsibility* and *dependability* (Fiske 1949; Tupes and Christal 1961; Digman and Takemoto-Chock 1981). The positive end of this factor is described using terms like *determined*, *responsible*, *insistently orderly* and *persevering,* while the negative end can be described by words such as *relaxed*, *indolent*, *frivolous* and *fickle*. In Goldberg's landmark study (1990), this personality factor was represented using terms that describe painstaking qualities, like *order*, *self-discipline*, *reliability*, *responsible* and *cautious*. The negative end of this personality factor is represented by terms such as *negligence*, *careless*, *lazy*, *inconsistency* and *aimless*. Goldberg named this factor *conscientiousness*. In traditional personality theory, traits reflecting aspects of conscientiousness have long been investigated, though independently of each other (Costa et al. 1991). Costa et al. (1991) provided examples of such traits, such as Webb's *will* factor (Webb 1915). This trait describes "the tendency not to abandon tasks in the face of obstacles" and a person's trustworthiness (Rothbart 2011, p.22). *Self-control* and *orderly* were other examples provided. These are also important components in Lorr's interpersonal traits (Lorr and Youniss 1973). Clearly, these traits echo the painstaking quality possessed by individuals. The negative continuum of conscientiousness was also investigated, producing terms such as *impulsivity*. Note that this impulsivity construct deals with quick decision times and a lack of persistence (Buss and Plomin 1975).

Costa et al. (Costa et al. 1991, p.889) described conscientiousness as containing both the "proactive and inhibitive aspects" of individuals. The proactive aspect of conscientiousness is manifested in terms of an individual's need for success and the degree to which someone pushes himself toward his goals. The inhibitive aspect is best described as an ability to control impulses. Unlike people with a low level of neuroticism, conscientious individuals learn to control their desires through planning and organizing. Low neuroticism people are able to resist their temptations because of their innate human quality – a low level of neuroticism. They do not learn to do so. In Costa and McCrae's model, conscientiousness is described in terms of six facets, namely: *achievement striving*, *competence*, *self-discipline*, *order*, *dutifulness* and *deliberation*.

Box 3-5: Facets of conscientiousness

Competence is a personality facet that refers to "the sense that one is capable, sensible, prudent, and effective" (Costa and McCrae 1992, p.18). People who possess a high level of this trait feel that they are well-prepared to deal with most situations. A high level of competence also gives rise to the perception that one is "in control" of the outcomes of various situations. In this respect, competence is highly correlated with Julian Rotter's concept of the locus of control (Rotter 1966).[22] People with a low level of competence have a low opinion regarding their abilities and perceive that they are often unprepared.

Order is a facet that deals with people's tendency to be "neat, tidy, and well organized" (Costa and McCrae 1992, p.18). People with a low level of order are less organized and less methodical.

Dutifulness describes the extent to which individuals adhere to their own principles. Dutifulness is best manifested in terms of the frequency and the magnitude a person exhibits his or her standards of conduct across different situations. People with a high level of dutifulness strictly follow their moral principles, while people with a low level of this trait are more casual.

Achievement striving refers to a person's tendency to try hard to achieve his or her goal. People with a high level of achievement striving strive for excellence in everything they do, however, they also have a tendency to become workaholics. On the other hand, individuals with a low level of achievement striving may be lazy, lack ambition and are not driven to succeed.

Self-discipline deals with a person's ability to begin some tasks and carry them through to completion, despite distractions. Individuals with a high level of self-discipline have the ability to motivate themselves to get a job done. In contrast, people who possess a low level of this trait tend to procrastinate and are easily discouraged.

Deliberation refers to a person's tendency to think carefully before acting. Individuals with a high level of this trait are cautious, while those who possess a low level of deliberation tend to speak or act without considering the consequences.

Source: Costa and McCrae (1992b)

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[22] The locus of control refers to the degree to which individuals perceive that positive or negative outcomes are contingent on one's own behavior.

At the core of the domain of conscientiousness are characteristic behavior such as being responsible, reliable, well-organized, and hard-working. Consequently it is reasonable to suspect that the qualities encompassed in this personality domain could be important in the CVM survey where the main task of participants is to consider and answer the questionnaire as conscientiously as possible. The level of respondents' conscientiousness could play an important role in determining how carefully and thoroughly they will perform the given task. In the next chapter, the theoretical predictions on how each facet of the conscientiousness domain will impact respondents' valuation decision will be made.

Taken together, this section offered insights into the five personality domains using a specific framework of the Big Five, one that has been developed and popularized by Paul T. Costa Jr. and Robert R. McCrae. The section highlighted a distinguished feature of this framework which is its multi-faceted approach for it helps to convey the many meanings of each personality domain. Domains and their facets are summarized in Table 3-2. The section also briefly discussed the potential relevance between each of the five personality domains and WTP response behavior. It appears that the five personality domains can have various influences on WTP response behavior. The theoretical links between the five personality domains and their associated facets on the on hand, and WTP response behavior on the other, will be scrutinized in more detail in Chapter 4. For now, it is worth introducing how the five domains and their facets can be measured in the real world.

Table 3-2: The Big Five and facets

Neuroticism	Extraversion	Openness to experience	Agreeableness	Conscientiousness
Anxiety	Warmth	Fantasy	Trust	Competence
Angry hostility	Gregariousness	Aesthetics	Straightforwardness	Order
Depression	Assertiveness	Feelings	Altruism	Dutifulness
Self-consciousness	Activity	Actions	Compliance	Achievement striving
Impulsiveness	Excitement-seeking	Ideas	Modesty	Self-discipline
Vulnerability	Positive emotions	Values	Tender-mindedness	Deliberation

3.2.3 The Big Five measurement tools

Over the years, a number of personality inventories have been developed to measure the components of the Big Five factor model, such as the International Personality Item Pool (IPIP) (Gow et al. 2005), the Big Five Inventory (BFI) (John and Srivastava 2001) and the Revised NEO personality inventory (NEO-PI-R) (Costa and McCrae 1992b; for more Big Five inventories see John and Srivastava 2001)). Of all the personality measures, the NEO-PI-R, and its shortened version the NEO-FFI, are the most widely used and validated (Rolland et al. 1998; Aluja et al. 2005; Gow et al. 2005).

The NEO-PI-R was first published in 1985 by Costa and McCrae with the aim of building a truly multi-purpose personality inventory or, in their own words, "a single instrument useful for understanding and predicting a wide variety of criteria such as vocational interests, health and illness behavior, psychological well-being, and characteristic coping styles" (Costa and McCrae 1992b, p.39). The self-administered version of this questionnaire consists of 240 items, each of which is a statement such as "*I always feel blue*," "*I easily get angry*," or "*I usually feel a burst of energy inside me*." Answers to these 240 statements must be given according to the five-point Likert scale (i.e. *very much disagree*, *disagree*, *neutral*, *agree* and *very much agree*). Some statements were negatively posed in order to detect respondents' consistency. From the 240 items, every eight items elicit a facet. The score of six facets constituting a domain can then be summed to produce the domain score. So, the NEO-PI-R provides information on both facet and domain levels.

With its 240 question items, the NEO-PI-R is rather lengthy for many empirical studies. It takes on average 45 minutes to one hour to complete the whole questionnaire (Costa and McCrae 1992b). In response to this problem, Costa and McCrae introduced a shorter version of the questionnaire, the Five-Factor Inventory (NEO-FFI) with 60 items, in 1992 (Costa and McCrae 1992b). The 60 items contained in the NEO-FFI were taken from the original 240 items. Out of the 48 items eliciting each domain in the NEO-PI-R, twelve items that have the highest factor loadings on the corresponding domain, and, thereby, contribute most to its overall meaning, were chosen for the new tool. One obvious benefit of this condensing of the measure is that the NEO-FFI can be used in a study where the time available for testing is limited. However, the cost for reducing the items to only one-fourth is that information on specific facets within each domain is no longer available. Therefore, the inventory is only recommended when global information on personality is considered sufficient (Costa and McCrae 1992b). Despite being condensed, the NEO-FFI has been found to have a high correlation with the NEO-PI-R. Costa and McCrae (1992b) found very satisfactory correlation coefficients when comparing the

NEO-FFI and NEO-PI-R (these being 0.92, 0.90, 0.91, 0.77 and 0.87 for scales measuring neuroticism, extraversion, openness to experience, agreeableness and conscientiousness respectively). It was also found that each group of 12 items selected to assess each personality factor had a satisfactory level of internal consistency, as measured by Cronbach's Alpha reliability index.[23] The Cronbach's Alpha of each personality factor was reported to be between 0.60 and 0.80 (Rolland et al. 1998; Panayiotou et al. 2004; Aluja et al. 2005).

An important question is: are both the NEO-PI-R and NEO-FFI applicable in non-English-speaking countries? The two tools are devised to assess the BFM, the framework of which was developed based on words found in English dictionaries and using Western personality theories. As a consequence, if the five personality domains were not present in the non-English speaking countries, datasets obtained from the NEO-PI-R and NEO-FFI would actually be meaningless.

An approach to this question is to directly test the Big Five measurement tools that have been developed in the English speaking world on people in the country of interest. This approach focuses on the cross-cultural validity of the BFM measurement tools (Cheung et al. 2011). In studies using this approach, the NEO-PI-R and the NEO-FFI is translated into various languages, then factor analysis is performed to analyze the latent personality structure of the datasets and to examine whether it coincides with the BFM. In general, findings from these studies suggest that factors similar to the Big Five emerge across western and non-English speaking countries, including Switzerland, Spain, Greece, Germany, Austria, Switzerland, Estonia, Finland and France. In addition, Zheng, et al. (2008), as well as McCrae et al. (2004), and Trull and Geary (1997), provided convincing empirical evidence that the NEO questionnaires can be employed in non-western societies, including China, Russia and the Czech Republic. The same holds true for countries speaking eastern languages such as Indian, Filipino and Vietnamese (McCrae et al. 1998; Leininger 2002; Lodhi et al. 2002). In 2005, McCrae and Terraciano (2005) attempted to validate the NEO-PI-R once and for all. They gathered data from 50 cultures representing six continents, including African and Arabic countries which had not been exhaustively investigated. The NEO-PI-R was employed in non-English speaking countries such as Thailand, Japan and Hong Kong. After the data from each

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[23] Cronbach's alpha is a scale indicating the degree to which a set of items measures a single latent construct (Shevlin et al. 2000). It is assumed that if a set of questions is eliciting the same underlying construct, they must have a high level of inter-correlation. Cronbach's alpha will generally increase as the inter-correlations among test items increase. The reliability scale ranges from 0 to 1, with 1 meaning that all questions elicit the same underlying psychological construct. The score 0 means that there is no correlation among different questions and that each question in the group assesses totally different psychological constructs.

country were pooled and standardized, the whole dataset was factor analyzed. The results "unmistakably" suggest a five-factor solution is applicable (McCrae and Terracciano 2005, p. 552).

Another approach to test the validity of the BFM in non-English speaking countries aims at exploring the indigenous personality characteristics of the people in such countries. In studies adopting this approach, indigenous personality terms are carefully collected from the native language. The investigators then use factor analysis to find whether or not the Big Five personality structure emerges from the trait terms people use in their daily lives in a particular country. A very good summary of cross-cultural studies conducted early on is given in Saucier et al. (2000), in which the authors review a total of 19 cross-cultural studies conducted in: Germanic (German, Dutch), Slavic (Polish, Czech, Russian), Romance (Italian, Spanish), and non-Indo-European languages (Hebrew, Hungarian, Turkish, Korean, Filipino). In all 19 studies, trait terms were gathered from the dictionaries of each local language and factor-analyzed in an attempt to find the Big Five personality dimensions. Saucier et al. (2000) reported that personality factors resembling those of the Big Five emerged from the Germanic languages. Slavic studies can also be considered as supportive of the BFM. However, the replication of the Big Five factors was somewhat less consistent in studies using the Romance languages (Italian and Spanish). Saucier et al. (2000) demonstrated that sub-components of emotional stability (neuroticism) were spread across several factors, and that the intellect factor (openness to experience) was not clearly recovered. For this reason, Saucier et al. called for more studies to be carried out with the romance languages. Studies using the non-Indo-European languages exhibited some minor deviations from the Big Five structure; nevertheless, Saucier et al. considered them to satisfactorily support the BFM. All in all, the authors concluded that the pattern of results tended to support the idea that approximately five basic trait clusters can be detected across different languages.

In summary, it has been shown here that the BFM has satisfactorily demonstrated its validity in both English and non-English speaking countries, supporting the basic premise that the BFM is a comprehensive and universal personality framework, one that represents the basic psychological aspects of individuals, regardless of their cultural, socio-economic and political backgrounds. As a result, it can be safely assumed that the NEO-PI-R and NEO-FFI can be employed in non-English speaking countries, producing personality data that are theoretically meaningful.

3.3 Summary

The goal of this chapter was to introduce the models and methods used in personality psychology to provide a better level of understanding and assessment of the mental attributes of CVM respondents. The review conducted with respect to the definition of the personality construct suggests that personality is a concept devised to take account of the sum total of a person's mental characteristics. However, due to the fundamentally broad nature of personality, attempts to pin down its elements during the 1930s to 1950s met with limited success. The theories of personality developed during that period shed light on parts of personality, but not the whole. It became clear that the phenomena embedded in the concept of personality are both complex and diverse, and that it would be impossible to unite all of these aspects in a single theoretical framework. Thus, during the 1950s to 1970s, personality theorists turned elementaristic, focusing their attention on conceptualizing and measuring basic units of personality, and this led to the dominance of trait theory. The main advantage of trait theory is that it operationalizes the concept of personality using trait dispositions, all of which can be conveniently measured using self-reporting mechanisms. Also, the premise was that knowledge about parts of the personality would enable theorists to form a theory about the whole. The chapter further showed that traits have a profound relevance when it comes to CVM decision-making, as they can be measured during a CVM survey using self-reporting inventories. Evidence also suggests that traits have an objective reality and can predict people's behavior in the real world. The use of traits in this study would therefore seem justified.

Section 3.2 looked closely at the BFM, the long-awaited, comprehensive theory of personality. After the explosion of trait research, which resulted in a bonanza of trait terms, trait theorists had enough resources and reasons to develop a comprehensive theory about personality. The BFM emerged out of two lines of inquiry; one associated with the distillation of trait terms in the English dictionary and another with the exploration of traits developed in traditional personality theories. Special attention was given to the BFM framework put forward by Costa and McCrae, who extensively investigated the reliability and validity of the BFM during the 1980s and early 1990s, and, therefore, increased the popularity of their framework. This section went into detail regarding Costa and McCrae's conceptions of the five personality domains and the 30 corresponding facets. It became apparent that the BFM provides a large number of powerful dispositions which can be used to explain many of the behavioral tendencies of individuals. So, it is very likely that by identifying respondents' personalities in terms of domains and facets we will be able to detect systematic patterns in their WTP answers.

The last part of Section 3.2 introduced the NEO-PI-R and NEO-FFI, both of which were developed by Costa and McCrae, but have since been verified by psychologists worldwide. The section came to the conclusion that both the model and the measurement tools used for the BFM could be employed in this study without reservation.

Chapter 4 Personality and contingent valuation

4.1 Review and outline of the chapter

This study set out to provide a comprehensive analysis of the role of personality characteristics for systematic distortions of WTP answers in contingent valuation surveys. As was laid out in detail in chapter 2, the systematic distortions contained in WTP answers may occur at two points during the course of a CVM interview. First, distortions may occur during the value formation process, i.e. when respondents have to form an idea of their individual valuation of some proposed environmental project. Some respondents in a CVM survey may not be able to form an exact idea of the future benefits they may expect from the environmental project proposed and as a consequence they may have wrong expectations regarding the project and ultimately biased estimates of their individual welfare changes. So, respondents who encounter problems during the value formation process may unknowingly misreport their WTP answers. Second, distortions of WTP answers may occur during the WTP elicitation. After forming an idea of their individual welfare changes resulting from the project, respondents are asked to report this individual evaluation in terms of WTP statements. Some respondents may deliberately misreport their WTP statements which also results in erroneous welfare estimates on the part of the researcher.

In order to search for the psychological factors that may lead respondents to misreport their WTP answers, the concept of personality trait was explored in chapter 3. Findings revealed that during their lifetime individuals are constantly influenced by their personality traits, which are dimensions of individual differences that causally determine an individual's enduring pattern of behavior. So, personality traits may be an important psychological factor that determines the answering behavior of respondents in CVM surveys and the relation between the two should be further analyzed. There are, however, a bonanza of trait descriptions that have been identified over the years. Due to this reason, the Big Five personality model was introduced. The basic idea of this personality model is that the whole sphere of trait characteristics of human beings can be represented by five personality domains which are labelled neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. As the five personality domains are very broad dimensions of personality, their meanings and components are described using facets, which are specific traits locating at

a lower level of trait hierarchy. Each of the five personality domains can be represented by six facets (see 3.2.2).

After the introduction of contingent valuation in chapter 2 and of the Big Five personality domains in chapter 3, this chapter will now develop the theoretical foundation of an empirical investigation of the influence of personality on WTP answers in contingent valuation surveys. It is in this chapter that the Big Five personality model is integrated into the CVM framework. The rest of this chapter is structured as follows. After this introductory section, section 4.2 offers a discussion on the importance of considering personality in environmental valuation. Three main reasons that call for an investigation of the influence of the personality in contingent valuation surveys are presented. First, it is suspected that the shortcomings of the CVM related to the formation of individual preference and the misreporting of WTP answers may have their root in the personality of respondents. Second, personality may be able to provide indications of individual preferences for the proposed project. Third, direct links between personality and answering behavior that are yet to be detected in this study can be used to verify WTP estimates in the future CVM surveys. Section 4.2 ends with the review of the empirical literature on the Big Five personality domains in CVM. It will become apparent that so far only little use has been made of insights on individual personality gained from the Big Five model to analyze the task of stating a WTP for an environmental public good in a contingent valuation surveys. In section 4.3, the theoretical relationship between a respondent's personality and the WTP response is analyzed in detail. For each personality domain, the analysis will be performed in two steps. First, theoretical considerations shall be made on the facet level. Second, the resulting theoretical links shall be aggregated to form the theoretical prediction on the domain level. Based on the theoretical predictions made, hypotheses of the influence of the five personality domains on stated WTP will be formulated. The conclusion of this chapter is given in section 4.4.

4.2 The importance of personality for contingent valuation

Analyzing the influence of personality in contingent valuation surveys is important for three reasons. First, systematic distortions contained in WTP answers may have their root in the personality of respondents. Distortions that occur during the value formation process, for a start, could result from the lack of effort from survey participants. It is conceivable that, because of their personality, some respondents may not have intrinsic incentive to exert effort into considering the project scenario. Consequently, they may have wrong expectations regarding

the project and consequently biased estimates of their individual welfare changes. Distortions that occur during the value elicitation process could also be the consequence of personal characteristics. It can be suspected that, because of their personal characteristics, some respondents may find it as their best choice to misreport their WTP answers. The relationship between personality and misreporting has long been recognized in survey research (e.g. Naemi et al. 2009; Van Vaerenbergh and Thomas 2012). Many types of misreporting have been found to be consistent over time and across different settings, suggesting that they are not situation-specific and tend to have their own cognitive and motivational roots (Weijters et al. 2010). Since personality may be the source of biases contained in WTP answers, systematic relationships between the personality of respondents and their stated WTP can be expected. This topic will be picked up again in the next section.

Second, personality traits of CVM respondents should be assessed because their traits may provide some indication of their preferences for the project proposed and thereby their WTP for that project. Both preference and personality are concepts which have been developed to explain heterogeneity in human behavior and so the relationships between the two have been long suspected (Albanese 1987; Almlund et al. 2011; Becker et al. 2012). Even though the specific form and the level of association between personality and preference still remain to be investigated, one can safely expect the personality scores of a person to give some indication of his or her preference regarding some specific subject. People who score high on openness to experience, for instance, can be expected to prefer novelty over familiarity. By identifying the personality characteristics of the respondents in CVM surveys, we may be able to deduce what their preferences (and thereby their WTP) for the project proposed would be like. Due to this reason, systematic associations between the personality of respondents and the amount of their stated WTP are anticipated. The specific forms of such associations will be discussed in the next section.

Third, from the direct links between WTP statements and personality traits that are yet to be detected in this study some generalizations can be made that may turn out to be useful as a guideline for the verification of WTP estimates of the future CVM surveys. From the discussion above, it can be seen that personality traits could be systematically related to stated WTP through two main avenues. First, some traits could be the source of response biases triggering the over- or understating of WTP, and second, other traits may be a good indication of people's preferences for the project proposed. Identifying respondents who score high on traits in the first category enables us to assess the bias that may contain in their WTP. At the same time, traits in the second category can also be used to identify untrustworthy responses. As the scores

of these traits should relate in particular ways with stated WTP, those WTP responses that do not conform to this expectation can be identified and excluded from the sample.

Empirical research on personality in environmental valuation

Despite the many ways in which personality could influence answering behavior in CVM surveys, no empirical research has been found that examines the effect of personality in such survey studies. One study, however, has used personality to explain answering behavior in ABCM like choice experiment. Soliño and Farizo (2014) applied a 10-item version of the Big Five Inventory (BFI-10) to identify the five personality domains of 2,224 dwellers from Castilla y León, Spain who participated in a discrete choice experiment conducted to quantify the social value of a program aiming at forest management. Results showed that on the one hand people who possess a high level of openness to experience and extraversion are more likely to choose the option for implementing the environmental program. On the other hand people who possess a high level of neuroticism and agreeableness are less likely to prefer the implementation of the program. The authors concluded that the Big Five personality domains clearly have an effect on the choices survey participants make and that personality are related to individual preferences for this particular environmental program.

Other authors chose to apply personality concepts to investigate the typical irregularities and biases that are encountered in stated-preference methods such as the hypothetical bias (Grebitus et al. 2013). Grebitus et al. (2013) used the Midlife Development Inventory (MIDI) scale to elicit the Big Six personality dimensions of 196 people from Bonn and Cologne, Germany who participated in real and hypothetical choice experiment and auctions. The Big Six personality model includes *agency* as the sixth personality domain. This domain is associated with people's tendency to be forceful and dominant, the aspect that is captured by a facet of extraversion (assertiveness) in the BFM. Results showed that the effects of personality domains on people's valuations differed between the real and hypothetical environments. The authors concluded that people of the same personality types tend to behave differently in hypothetical and real settings, suggesting that personality traits explain at least a portion of hypothetical bias.

In sum, a few studies could be found that analyze the influence of personality on the choices respondents make in choice experiment and on the often found biases in stated-preference methods such as the hypothetical bias. No previous study, however, has employed personality concept to detect systematic biases contained in WTP answers in CVM interviews. The aim of this study, therefore, is to provide a comprehensive analysis of the role of personality

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for systematic biases contained in WTP answers in contingent valuation surveys. For this purpose, two research questions will be addressed in this study and they will be presented in the next section.

4.3 Effects of five personality domains on WTP answers

The main aim of this study gives rise to two specific research questions for investigating the importance of the five personality domains in environmental valuation surveys the first of which is:

1) Do respondents in CVM interviews possess personality structure that is consistent with the Big Five?

This first research question is crucial as it forms a necessary condition for the BFM to be useful in the CVM. It is clear that if CVM respondents do not possess the five personality domains, there is no reason to further evaluate the usefulness of the BFM in the context of the CVM. However, it is reasonable to expect that respondents in the CVM do possess a personality structure that is consistent with the Big Five. This is because of the universality of the Big Five model and the empirical evidence which has been shown in section 3.2.3 –the model has been replicated across individuals from various sociocultural contexts. Due to this reason the following hypothesis can be formulated.

> **Hypothesis 1:** Respondents possess a personality structure that is consistent with the Big Five

In order to test whether CVM participants have the personality structure that is consistent with the BFM, a Big Five inventory will be employed in the practical CVM survey. The obtained data will be factor analyzed to detect the latent structure of the data. If the five factor structure does not emerge out of the dataset, it means that the personality structure of CVM respondents does not resemble that of the BFM. On the contrary, if results from the factor analysis reveal the structure of the five personality dimensions, it can be safely concluded that CVM respondents possess a personality structure that resembles that of the BFM. This leads to the second research question:

2) If the BFM personality structure can be detected for CVM respondents, what are the relationships between the Big Five personality characteristics and their WTP statements?

The purpose of this second research question is to scrutinize the effects of the Big Five personality domains on WTP statements. While the first research question represents the necessary condition to justify the usefulness of the BFM in the context of contingent valuation interviews, this second research question can be considered as the sufficient condition. That is, if there is no systematic relationship between the personality of a CVM respondent and any of his or her WTP answers, the Big Five personality model is not needed for the CVM as no insights can be gained. In order to answer this second research question, hypotheses on how the five personality domains might affect the stated WTP of survey participants must first be formulated. This will be done in the next sections for each of the five domains in turn.

4.3.1 Neuroticism

The neuroticism domain is made up of six facets, i.e. anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability. Therefore, this section is further subcategorized into six small parts labeled after the six facets of neuroticism. In each part, the relationship of the individual facet and WTP response behavior is scrutinized. After considering all the six facets, the hypothesis on how neuroticism affects the stated WTP will be formulated.

Anxiety

It was mentioned before that anxiety is a facet of neuroticism which gives rise to feelings associated with fear. Anxious individuals are fearful, nervous, and tense. They are inclined to have free-floating anxiety and to dwell on things that might go wrong. Anxiety is measured by question items such as: "*I am easily frightened*", "*I often feel tense and jittery*", "*I often worry about things that might go wrong*" and "*Frightening thoughts sometimes come into my head*". Because of their free-floating anxiety, anxious individuals are inclined to perceive greater risk in all situations and are also more likely to make risk-averse choices than calm individuals (Lerner and Keltner 2000). Following this, CVM respondents who obtain a high score on anxiety should also be expected to perceive a greater level of risk in their lives than respondents with a low level of anxiety. Such risk can be perceived with respect to, for instance, possible future financial difficulties or other unexpected events in the future. Due to this reason, fearful

respondents must be expected to make a risk-averse choice when stating their WTP and thus understate their contribution to the proposed environmental project.

Angry Hostility

Angry hostility represents an individual's tendency to experience the feeling of anger and related states such as frustration and bitterness. This facet is assessed by question items such as: "*I often get angry at the way people treat me*", "*Even minor annoyances can be frustrating to me*" and "*I often get disgusted with people I have to deal with*". In contingent valuation surveys, it can be expected that respondents with a high score on angry hostility can easily get angry at the way they are treated during the interview or at the formulations or statements in the questionnaire. Consequently, it is conceivable that they are likely to give WTP responses which reflect differing sorts of annoyance rather than their true individual valuation of the proposed project. Negative effect of angry hostility on WTP statements can therefore be anticipated.

Depression

Depression is expected to lead to understating WTP. This facet of neuroticism deals with feelings of sadness, hopelessness, and loneliness. It is assessed by statements such as: "*Sometimes I feel completely worthless*", "*I have sometimes experienced a deep sense of guilt or sinfulness*" and "*Sometimes things look pretty bleak and hopeless to me*". CVM respondents with a high score of depression are likely to have low mood and an absence of interest in many aspects of life. This is likely to include the lack of interest in the environmental project to be valued. The absence of interest in the proposed environmental project and the tendency to feel despair believing that nothing will turn out well for them neither in the near nor far future are likely to motivate depressed respondents to report a low WTP amount regardless of their individual valuation of the project. On top of that, the tendency to expect the worst in all things could also lead depressed individuals to have protest belief, i.e. protest attitudes associated with the constructed market scenario. The relation between neuroticism and protest belief will also be tested in Chapter 5.

Self-Consciousness

It is to be anticipated that self-conscious participants in the CVM survey will understate their WTP answer. Self-consciousness deals with the propensity of an individual to experience the feeling of inferiority. Question items designed to measure this facet are for example, "*I often feel inferior to others*". CVM respondents with a high score of self-consciousness can be

expected to classify the situation of their households as being worse than others. They are those who receive continuous pressure from the feelings of inferiority and low self-esteem. This could lead high scorers to report low WTP statements for the proposed environmental program independent of their valuation of it.

Impulsiveness

Impulsiveness is the facet of neuroticism that deals with a person's inability to control his or her cravings and urges. It is assessed by question items like "*I have trouble resisting my cravings*", "*When I am having my favorite foods, I tend to eat too much*" and "*I sometimes eat myself sick*". These question items indicate that high scorers on impulsiveness have difficulties in resisting their inner urges and have a high tendency to behave or react to certain stimulants in a way that they will later regret. As the tendency to be the victim of eating disorder of CVM respondents is clearly not relevant to their valuation of environmental goods, it can be safely expected that impulsiveness does not influence individual WTP answers.

Vulnerability

Vulnerability is another facet of neuroticism that is not relevant to the context of this study. Vulnerability determines an individual's inability to cope with stress. Individuals who score high on vulnerability feel panicked when facing with emergency situations. Question items designed to assess this facet are, for example: "*I often feel helpless and want someone else to solve my problems*" and "*When I'm under a great deal of stress, sometimes I feel like I'm going to pieces*". Obviously, the tendency of respondents to be susceptible to stress is neither relevant to how they will value the individual benefits accruing from an environmental project nor how they will report the perceived value of such a project. As a result, no plausible connection between stated WTP and vulnerability can be established.

Now that the effects of all individual facets of neuroticism on WTP statements have been considered, these effects must be considered together so that the theoretical prediction on the domain level can be made. Putting everything together, it appears that neuroticism is not a desirable personality characteristic if what we want from CVM respondents are their reliable answers regarding their WTP for an environmental change scenario. Four facets (anxiety, angry hostility, depression, and self-consciousness) are expected to produce disturbing influence on CVM respondents when they are reporting their WTP. All of them can be anticipated to motivate respondents to understate their WTP for the proposed project. Through depression, the relation between neuroticism and protest belief is also expected. The other two facets

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(impulsiveness and vulnerability) appear to be irrelevant to the context of contingent valuation surveys. Due to this reason, the following hypothesis can be formulated.

> **Hypothesis 2:** Respondents with a high level of neuroticism are more likely to state a significantly lower WTP than respondents with a low level of neuroticism

4.3.2 Extraversion

This personality domain consists of six facets namely warmth, gregariousness, activity, excitement-seeking, assertiveness, and positive emotions. The expected relationships between these facets and WTP answers will be discussed in turn beginning with warmth.

Warmth

Warmth is suspected to trigger overstating of WTP. This facet of extraversion deals with a person's ability to form and maintain close relationships with others. It is measured by items like: "*I find it easy to smile and be outgoing with strangers*", "*I take personal interest in the people I work with*", "*I really enjoy talking to people*" and "*I have strong emotional attachments to my friends*". According to these items, individuals exhibiting this facet are friendly people. When it comes to the context of contingent valuation surveys, the friendliness of respondents may prove to be a threat to the validity of their WTP answers. This is because the WTP of respondents who are affectionate and friendly are likely to be more susceptible to the presence of interviewers than that of reserved respondents. Respondents exhibiting this facet may give WTP answers that reflect their friendliness rather than their valuation of the proposed environmental program. They are likely to overstate their WTP as a result.

Gregariousness

Gregariousness is also suspected of leading respondents to overstate their WTP. This facet of extraversion gives rise to the preference for other people's company. It is assessed by question items like "*I like to have a lot of people around me*", "*I really feel the need for other people if I am by myself for long*" and "*I'd rather vacation at a popular beach than an isolated cabin in the woods*". What these items clearly imply is the fact that high scorers on gregariousness items assign a high value to social interactions. This characteristic of gregariousness may put a serious threat to in-person contingent valuation surveys. In an in-person CVM survey (like face-to-face and telephone surveys) the interaction between interviewers and respondents is prominent.

Gregarious respondents are likely to put special attention to the interpersonal aspect of the survey. They may feel the urge to maintain good atmosphere between them and interviewers by reporting WTP answers that they deem desirable but have no relevance to the welfare changes they expect from the proposed environmental project. Following this line of reasoning, extraversion mediated through gregariousness can give rise to the overstating of WTP answers.

Activity

No relationship is expected between activity and WTP response behavior. As mentioned in chapter 3, activity deals with the level of mental energy that individuals possess. Individuals with a high level of this facet feel more energetic and need to live a busy life. Activity is assessed by question items like "*I often feel as if I'm bursting with energy*", "*I am a very active person*" and "*When I do things I do them vigorously*". It is quite obvious that the tendency to have a fast-paced lifestyle is not relevant to the valuation of environmental goods. Thus, this facet will not be considered further.

Excitement-seeking

The relevance between excitement-seeking and WTP answers is not expected. This facet of extraversion is responsible for the need for excitement and stimulation within individuals. It is measured by statements like "*I love the excitement of roller coasters*", "*I have sometimes done things just for kicks or thrills*" and "*I'm attracted to bright colors and flashy styles*". Since there is no reason why the love for "kicks" or "thrills" of individuals should affect their WTP response behavior, excitement-seeking is not expected to influence the WTP answers.

Assertiveness

Assertiveness is not expected to have influence on stated WTP. This facet refers to the tendency of individuals to be forceful, dominant, and outspoken. It is measured by items like "*I am dominant, forceful, and assertive*" "*I have often been a leader of groups I have belonged to*" and "*In conversations, I tend to do most of the talking*". Given such characterization of assertive individuals, it comes as no surprise that assertiveness has been a prime suspect of triggering a response bias known as extreme response style (Harzing 2006). The extreme response style is the "tendency to endorse the most extreme response categories regardless of content" (Baumgartner and Steenkamp 2001, p.145). But since the extreme response style comes into play only when the Likert scale is used (see 3.2.2 for the explanation of the Likert scale), assertiveness does not expect to influence the stating of WTP. The relation between extraversion

and the tendency to endorse the extreme options of Likert scale, however, will be tested in Chapter 5.

Positive emotions

It is anticipated that positive emotions lead to the overstating of WTP. This facet of extraversion refers to the "tendency to experience positive emotions such as joy, happiness" (Costa and McCrae 1992, p.17). It is measured by question items such as "*I have sometimes experienced intense joy or ecstasy*", "*I am not a cheerful optimist* (reversed score)" and "*I am a cheerful, high-spirited person*". In the literature of decision science dealing with the effects of positive feelings on decision makings, evidence suggests that positive emotions signifies individuals that "all is well," and discourages individuals to engage in a careful evaluation of the situation (Loewenstein and Lerner 2003, p.629). Thus, in the context of the CVM, it can be reasonably expected that survey participants with a high level of positive emotions likely overstate their WTP.

In conclusion, extraversion is an undesirable personality characteristic within CVM respondent as it likely distorts their WTP statements. Three facets of extraversion likely lead to the misreporting of WTP (warmth, gregariousness, and positive emotions). Because these three facets lead to the overstating of WTP, it can be expected that extraversion also produces an overall positive effect on stated WTP. Extraversion, mediated through assertiveness, is also expected to be related to extreme response style. The other two facets of extraversion (activity and excitement-seeking) are expected to be irrelevant to the context of CVM. Thus, the following hypothesis can be formulated.

> **Hypothesis 3:** Respondents with a high level of extraversion are more likely to state a significantly higher WTP than respondents with a low level of extraversion

4.3.3 Openness to experience

The six facets of openness to experience are fantasy, aesthetics, feelings, actions, ideas, and values. The theoretical links between these six facets and the WTP response behavior will be examined below.

Fantasy

This personal attribute is suspected to have no influence on WTP answers. Fantasy is responsible for individual differences among people in their willingness to use and enjoy their imagination. This facet of openness to experience is assessed by question items like "*I have an active fantasy life*", "*I enjoy concentrating on a fantasy or daydream and exploring all its possibilities, letting it grow and develop*" or "*As a child I rarely enjoyed games of make believe* (reversed score)". High scorers on these scales enjoy using imagination. Low scorers on these scales are interpreted to be "prosaic" (Costa and McCrae 1992b, p.17). When it comes to contingent valuation surveys, respondents who score high on fantasy are likely to be more motivated to craft the mental image of the proposed project than low scorers. However, this does not necessarily mean that they will expect a larger welfare change from the program (and should thereby give higher WTP answer) than low scorers. Due to this reason, no relationship between fantasy and WTP answers is expected.

Aesthetics

It is suspected that aesthetics has no influence on WTP answers. This facet of openness to experience describes people's preference for art and music. It is measured by question items such as "*I am sometimes completely absorbed in music I am listening to*" and "*Poetry has little or no effect on me* (reversed score)". Aesthetics also covers the individual appreciation for the beauty of the natural environment: "*I am intrigued by the patterns I find in art and nature.*" Because of this, this facet may prove to be important for the CVM if the proposed program involves, e.g. the improvement of the beauty of a particular landscape. However, if the scenario only includes the improvement of tap water supply and the change of land use in upstream areas like in the survey conducted for the empirical part of this study, aesthetics is not expected to play any role in determining WTP answers.

Feelings

No relationship is expected between feelings and WTP answers. Feelings gives rise to the willingness to examine one's own emotions. This facet is measured by question items like "*I seldom pay much attention to my feelings of the moment* (reversed score)" and "*I seldom notice the moods or feelings that different environments produce* (reversed score)". Low scorers on feelings are blunted. They rarely pay attention to how they feel. It is safe to expect that CVM respondents who score high on feelings are intrinsically motivated to scrutinize their level of welfare changes resulting from the proposed environmental project. High scorers are familiar

with pinpointing their own emotions in different situations and thus are expected to better recognize the level of their welfare changes than low scorers. However, high scorers on feelings do not necessarily obtain a higher level of welfare change from the program than low scorers. Because of this, the relationships between feelings and WTP answers are not expected.

Actions

Actions is expected to lead to comparably high WTP answers. This facet of openness to experience represents the extent to which a person prefers novel activities. The facet is assessed through eight question items, e.g. "*I think it's interesting to learn and develop new hobbies*", "*I often try new and foreign foods*" and "*Sometimes I make changes around the house just to try something different*". High scorers on this facet have a higher tendency to adopt new products, goods, or services than low scorers. They are likely to be opinion leaders as they are more likely to obtain information from media rather than through word of mouth. Due to these reasons, actions may come into play and have a very important role in the context of contingent valuation survey. Because the provision of environmental goods introduces changes and novelty, high scorers on actions are likely to obtain a higher level of welfare changes resulting from the project than low scorers. As a result, it is reasonable to expect that high scorers on actions are willing to pay more for the proposed environmental project than low scorers.

Ideas

Ideas is not expected to influence WTP answers. This facet represents the level of intellectual curiosity. It is elicited by statements about the extent to which individuals take pleasure from mental exercises. These statements are for example: "*I often enjoy playing with theories or abstract ideas*", "*I enjoy solving problems or puzzles*" and "*I have a wide range of intellectual interests*". People who receive high scores from ideas scales are those who actively pursue intellectual interests. Low scorers, on the contrary, have a limited area of interests. It can be expected that people who have high scores on ideas, i.e. high intellectual interests, will be more motivated to put mental effort in considering about the project scenario. But since respondents who think more about the program do not necessarily want to pay more for it, no clear relationship between ideas and WTP answers can be expected.

Values

Values is not expected to influence WTP answers. This facet of openness to experience determines a person's readiness to re-examine ideals. High scorers on this facet are ready to

question social, political, and religious values. The items of this facet are for example: "*I believe that laws and social policies should change to reflect the needs of a changing world*", "*I believe that the different ideas of right and wrong that people in other societies have may be valid for them*" and "*I believe that loyalty to one's ideals and principles is more important than open-mindedness* (reversed score)". High scorers on such scales are interpreted as people who do not believe in conventional ideals. Low scorers on values can be easily described as conservative and traditionalist. It is rather obvious that people's readiness to examine ideals has nothing to do with how they will value the environmental improvements and how well they will do it. Therefore, the facet values will not be considered further.

It can be easily observed that openness to experience is a desirable attribute within individuals when it comes to contingent valuation surveys. Many of its facets provide intrinsic incentive for CVM respondents to put more effort into considering the proposed environmental change scenario (fantasy, feelings and ideas). However, these facets are not expected to be related to the amount of stated WTP as the level of effort individuals put into considering the proposed project cannot be related to the level of their individual welfare changes. Yet, these facets could be positively associated with the amount of time people use for answering the questionnaire. It has been found that the more time people use to answer survey questions the more effort they are likely to put into considering and answering such questions (Bassili and Fletcher 1991; Fletcher and Chalmers 1991). Due to this reason, openness to experience mediated through fantasy, feelings, and ideas can be expected to be positively associated with the response time CVM respondents use for answering the questions. The relation between openness to experience and response time will be tested in the next chapter.

The only facet of openness to experience that is related to WTP answers is actions. The tendency to be receptive to new ideas and to adopt them may lead high scorers on actions to be willing to pay more for the proposed program than low scorers. Due to these reasons, the domain of openness to experience is expected to be positively associated with stated WTP, i.e. the higher the score of openness to experience, the higher stated WTP.

Hypothesis 4: Respondents with a high level of openness to experience are more likely to state a significantly higher WTP than respondents with a low level of openness to experience

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4.3.4 Agreeableness

Trust

People who have a high level of this facet are predisposed to believe that others are well-intentioned. It is measured by items like "*I believe that most people are basically well-intentioned*, "*I think most of the people I deal with are honest and trustworthy*" and "*I have a good deal of faith in human nature*". Trust can be a very important personal attribute when it comes to in-person contingent valuation surveys. This is because this facet may directly affect the effort respondents' put into answering questions. Respondents who trust interviewers tend to answer questions thoroughly and completely (Roulston 2003; Groves et al. 2004). Due to this reason, it can be reasonably expected that CVM respondents with a high level of trust may put more effort into considering the project scenario than low scorers of this facet. But since respondents who think more carefully about the program do not necessarily pay more for it than respondents who think less, neither a positive nor a negative effect of trust on stated WTP is expected. However, trust may be positively associated with response time.

Straightforwardness

Straightforwardness is measured by items such as: "*I'm not crafty or sly*", "*If necessary, I am willing to manipulate people to get what I want* (reversed score)", "*I couldn't deceive anyone even if I wanted to*", "*At times I bully or flatter people into doing what I want them to* (reversed score)" and "*Being perfectly honest is a bad way to do business* (reversed score)". When it comes to the context of this study, respondents with a high level of this facet can be expected to be frank and sincere. Yet, no systematic influence of straightforwardness on stated WTP can be expected. Some ingenuous respondents may dislike the project and thus state low WTP answers while others may give higher WTP answers because they prefer the project.

Altruism

Altruism is anticipated to influence stated WTP positively. This facet is an aspect of agreeableness determining "selflessness and concern for others" (Costa et al. 1991, p.888). It is assessed by question items such as "*I go out of my way to help others if I can*", "*I think of myself as a charitable person*", "*I am not known for my generosity* (reverse score)" and "*Some people think I'm selfish and egotistical* (reversed score)". Altruists have active concern for other's welfare and they are willing to assist others in need of help. When it comes to the valuation of environmental goods, the effects of altruism on WTP statements can assumed to be positive.

Respondents who score high on altruism are those who have active concern for others and so they are likely to obtain a higher level of welfare changes resulting from the project. In contrary, respondents who score low on altruism focus only their personal benefits and so they are likely to obtain a lower level of welfare changes than the high scorers. Thus, it is assumed that altruism will affect WTP answers positively.

Compliance

Compliance determines individual reactions to interpersonal conflict. It is assessed by questions like "*I hesitate to express my anger even when it's justified*," "*When I've been insulted, I just try to forgive and forget*", "*If I don't like people I let them know it*" (reversed score), "*I can be sarcastic and cutting when I need to be*" (reversed score). According to these question items, compliance gives rise to the ability to inhibit anger expression in conflict situations. In the CVM, compliant respondents are unlikely to express their anger or resentments when they encounter "conflicts" in CVM studies, e.g. when they dislike the interviewer or feel offended by certain statements in the CVM questionnaire. Compliant respondents are unlikely to understate their WTP because of emotional reasons. Thus, compliance can be assumed to produce the non-negative effect on people's WTP statements.

Modesty

Modesty is not expected to systematically influence stated WTP. This facet of agreeableness represents the individual tendency to be "humble and self-effacing" (Costa and McCrae 1992, p.18). High scorers on the modesty facet are not preoccupied with themselves. On the contrary, low scorers on modesty have "inflated views of themselves" (Costa et al. 1991, p.889). They strongly believe in their superiority and are prone to narcissism. As neither people's tendency to be humble nor their tendency to be narcissistic is likely to influence their individual valuation of the environmental change scenario, no effect of modesty on stated WTP is expected.

Tender-mindedness

Tender-mindedness refers to the tendency of individuals to be guided by the feeling of sympathy in making decisions. This facet is assessed by question items such as: "*I would rather be known as merciful than just*", "*Human need should always take priority over economic consideration*" and "*I believe all human beings are worthy of respect*". When it comes to the valuation of environmental goods, it is reasonable to expect that tender-mindedness will have positive

effects on individuals' WTP answers. This is because high scorers on tender-mindedness will likely base their WTP decisions on the feelings of sympathy. So, they are hypothesized to be willing to contribute more for the provision of environmental public goods than low scorers who are likely to make contribution decisions, which are characterized as just.

To sum up, agreeableness contains many desirable personal attributes when it comes to contingent valuation surveys. Through compliance, agreeableness can be expected to motivate respondents to forgive and forget, making their stated WTP resistant to the various negative effects that might be induced by the formulations of the questions. Through trust, agreeableness may motivate respondents to put more effort into considering and answering the questions. So, agreeable people can be expected to use more time to answer survey questions. This prediction will be tested in the next chapter. Through characteristics like altruism and tender-mindedness, agreeableness may affect how survey participants perceive the benefits from the environmental project, basing their valuation decisions on other people's welfare as well as the feelings of sympathy. Therefore, positive association between agreeableness and stated WTP can be anticipated.

Hypothesis 5: Respondents with a high level of agreeableness are more likely to state a significantly higher WTP than respondents with a low level of agreeableness

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4.3.5 Conscientiousness

Competence

No relationship is expected between competence and WTP answers. Competence refers to the tendency of individuals to feel capable, sensible, and effective. It is assessed by question items like "*I keep myself informed and usually make intelligent decisions*", "*I pride myself on my sound judgment*" and "*I am efficient and effective at my work*". Since the tendency to feel capable of a person does not have anything to do with his or her valuation of environmental change scenario, competence is considered as irrelevant to the stated WTP.

Order

Order is not expected to have any influence on stated WTP. This facet of conscientiousness deals with the tendency of a person to be neat, tidy, and well-organized. It is measured by items like: "*I keep my belongings neat and clean*", "*I like to keep everything in its place so I know*

just where it is" and "*I tend to be somewhat fastidious or exacting*". The tendency of people to be orderly is obviously irrelevant to their valuation of environmental improvement projects. So, order is not expected affect stated WTP.

Dutifulness

Dutifulness is not expected to influence stated WTP. This facet refers to the tendency of people to adhere to their ethical codes. It is measured by items like: "*I pay my debts promptly and in full*", "*I adhere strictly to my ethical principles*" and "*I'd really have to be sick before I'd miss a day of work*". In easy words, dutiful individuals are dependable. Whether or not the person is dependable should not be relevant to his or her valuation of environmental projects. Thus, dutifulness is not expected to be relevant to WTP answers.

Self-discipline

It is anticipated that self-discipline does not affect stated WTP. This facet deals with a person's ability to begin tasks and complete them regardless of distractions and boredom. It is assessed by questions such as: "*I'm pretty good about pacing myself so as to get things done on time*", "*I am a productive person who always gets the job done*" and "*Once I start a project, I almost always finish it.*" The tendency of individuals to be disciplined should not be related to how they value an environmental project. Therefore, the relationship between self-discipline and stated WTP is not expected.

Achievement striving

The relationship between achievement striving and stated WTP is not expected. Achievement striving refers to the tendency of individuals to have high aspiration levels and to work hard to achieve their goals. It is assessed by items like: "*I have a clear set of goals and work toward them in an orderly fashion*", "*I work hard to accomplish my goals*" and "*I strive to achieve all I can*". The tendency of individuals to be ambitious and work hard should not be related to their valuation of an environmental project. So, no relationship between this facet and stated WTP is expected.

Deliberation

A positive relationship between deliberation and response time is expected. Deliberation deals with people's propensity to be cautious and thoughtful. This facet of conscientiousness is

measured by question items like "*I think things through before coming to a decision*", "*I always consider the consequences before I take action*", "*I rarely make hasty decisions*" and "*I think twice before I answer a question*". These items imply that individuals who score high on deliberation are more ready to make effortful decisions (Costa and McCrae 1992, p.18). Individuals scoring low on deliberation are more spontaneous and tend to make hasty decisions. It can be expected that deliberate respondents will make extensive and careful WTP decisions. Deliberate respondents are expected to scrutinize all given information that is relevant for the valuation of the proposed scenario. So it is very likely that they will use more time to answer the survey questions than low scorers on deliberation who, by contrast, are less likely to have every detail of the project spelled out before making contribution decisions. Due to this reason, a positive association between deliberation and response time is expected. This link be tested in chapter 5. Deliberation, however, is not expected to determine WTP statements. This is because respondents who put more effort into thinking about the program do not necessarily want to pay more for it.

In sum, five out of six facets of conscientiousness, i.e. competence, order, dutifulness, achievement striving, and self-discipline, are expected exhibit no relevance to the CVM. A positive relation is expected between deliberation and response time. No facets of conscientiousness is expected to be related to stated WTP. Due to this reason, the following hypothesis can be formulated.

Hypothesis 6: Conscientiousness does not have an effect on WTP statements

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Table 4-1 summarizes the expected influence of the Big Five personality traits on stated WTP. Neuroticism and extraversion are expected to be the source of biases contained in WTP answers. Whereas neuroticism is expected to motivate respondents to understate their WTP, extraversion can be expected to trigger the overstating of the WTP. Openness to experience and agreeableness, on the other hand, are expected to provide indication of people's WTP for a public project. Positive association between openness to experience and stated WTP is expected because open individuals prefer new activities and therefore they may be willing to pay more for the planned environmental project. Positive relation between agreeableness and stated WTP is also expected. This is because agreeable people are altruistic and tender-minded. So they are expected to be willing to pay more for the public project.

Table 4-1: Expected influence of personality on stated WTP

Domain	Facet	Expected influence on stated WTP	Expected influence on stated WTP
Neuroticism	Anxiety	Negative	Negative (Hypothesis 2)
	Angry hostility	Negative	
	Depression	Negative	
	Self-Consciousness	Negative	
	Impulsiveness	None	
	Vulnerability	None	
Extraversion	Warmth	Positive	Positive (Hypothesis 3)
	Gregariousness	Positive	
	Activity	None	
	Excitement-seeking	None	
	Assertiveness	None	
	Positive emotions	Positive	
Openness to experience	Fantasy	None	Positive (Hypothesis 4)
	Aesthetics	None	
	Feelings	None	
	Actions	Positive	
	Ideas	None	
	Values	None	
Agreeableness	Trust	None	Positive (Hypothesis 5)
	Straightforwardness	None	
	Altruism	Positive	
	Compliance	Non-negative	
	Modesty	None	
	Tender-mindedness	Positive	
Conscientiousness	Competence	None	None (Hypothesis 6)
	Order	None	
	Dutifulness	None	
	Self-discipline	None	
	Achievement striving	None	
	Deliberation	None	

4.4 Summary

In this chapter, a theoretical foundation of an empirical investigation of the influence of personality on WTP answers is developed. The chapter begins with the discussion on the importance to consider personality in environmental valuation. It turns out that there are three main reasons that call for a systematic analysis of personality in the context of CVM. First, systematic distortions contained in WTP answers may have root in the personality of respondents. Second, personality may be able to provide some indication of people's WTP for the project to be valued. Third, direct links between stated WTP and personality to be detected may be useful for the verification of WTP estimates of the future CVM studies. After the importance of personality in CVM is discussed, the empirical literature of the BFM in CVM is reviewed. It becomes apparent that no previous study has ever employed the BFM to detect systematic biases that may be contained in WTP answers. Due to this reason, theoretical links between the Big Five personality domains and WTP statements are scrutinized in detail. Because of the multi-faceted structure of the five personality domains, in the first step the analysis is made on the facet level. Resulting theoretical links are then considered aggregately in the second step to form the theoretical predictions on the domain level. It becomes apparent that two domains can be expected to be the source of biases in WTP answers. These are neuroticism and extraversion. Openness to experience and agreeableness are expected to be positively related to people's WTP for an environmental project. Relation between conscientiousness and stated WTP is not expected. These theoretical predictions will be tested in the next chapter.

Chapter 5 Empirical analysis

In the preceding chapter, a theoretical framework for the analysis of the effects of the Big Five personality domains on WTP statements in CVM surveys was developed. After finding that the five personality domains are a potential source of biases contained in WTP answers, the theoretical links between the five personality domains and WTP statements were scrutinized in detail. On the basis of the obtained theoretical insights, six research hypotheses were formulated in the last chapter, so the main aim of this chapter is to present the results of the empirical work to test these six hypotheses.

As a result, this chapter is organized into four sections. The next section, section 5.1, presents the background to a practical CVM survey aimed at assessing the social value of a tap water improvement program that was conducted in Chiang Mai, northern Thailand. This section introduces the Uplands Program, a collaborative research project run by universities and research institutes from Germany, Vietnam and Thailand, and which provided the framework for the empirical CVM survey. Thereafter, the study area and its environmental problems, those which have led to the need for a tap water improvement program, will be described. Details of the CVM questionnaire and Big Five inventory (the NEO-FFI) are also provided in this section. Following section 5.1, section 5.2 presents the results of the survey, beginning with a report on the general socio-economic characteristics of the CVM respondents. It then describes indicators of the reliability and validity of the personality data obtained from the NEO-FFI. This is followed by a detailed analysis of the impact of the five personality domains on WTP statements. A discussion of the results follows in section 5.3.

5.1 General survey settings

This section contains three sub-sections. Section 5.1.1 starts with the background to the empirical CVM survey conducted in Chiang Mai Province, northern Thailand, after which section 5.1.2 provides information on the research design. The practical realization of the survey is then covered in section 5.1.3.

5.1.1 Background to the research project

The Uplands Program

The CVM survey was carried out to test the effects of the Big Five on WTP statements, and was part of the collaborative research project "Research for Sustainable Land Use and Rural Development in Mountainous Regions of Southeast Asia" (Sonderforschungsbereich 564, or SFB564) and commonly known as the Uplands Program. The Uplands Program was a collaborative research project run by nine universities and research institutes in Germany, Vietnam and Thailand. The program began in July 2000 and completed its work in June 2012. Its activities were financed by the German government via the German Research Foundation, or Deutsche Forschungsgemeinschaft (DFG). The focus of the program was to contribute to a scientific advancement of the sustainable use of land and rural development in the mountainous regions of Southeast Asia. The two main study areas covered by the program were in northern Thailand (mainly in Chiang Mai Province), and in northern Vietnam (Son La Province). Since the CVM survey conducted for this study was based in Thailand, only the Thai part of The Uplands Program will be described here.[24]

In the mountainous regions of northern Thailand, where market-based agriculture predominates, the resulting intensive land use activities put tremendous pressure on both land productivity levels and the natural environment in general (Kaosa-ard 2001). This trend can be observed in most watersheds across northern Thailand, where upland populations have been steered toward market-oriented agricultural practices. The outcomes of this have been a deterioration in both short- and long-term agricultural productivity levels in the highland areas and also a deterioration of the quality of the natural environment there (Heidhues and Pape 2007). These activities are having negative impacts on the well-being of both highlanders – those living in the area, and lowlanders living in downstream areas. The aims of the Thai part of the Uplands Program were to advance scientific knowledge and help increase the productivity of highland agriculture, while at the same time minimizing its adverse impacts on the natural environment and also on human communities. To achieve these goals, the program brought together scientific expertise from different knowledge domains, such as horticulture, entomology, plant pathology, agricultural engineering, sociology and economics. Based on these knowledge domains, 16 research topics from the natural sciences (e.g. fertigation strategies, agrochemical and pest management, post-harvest technology) and social sciences

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[24] For more details of the Vietnamese part of the program see http://www.uni-hohenheim.de/sfb564/.

(e.g. participatory research, rural finance, marketing and environmental valuation) were developed as the program's main research components in Thailand. This interdisciplinary research idea behind the Uplands Program was shown to be very effective at scrutinizing highland resource management systems and rural livelihoods (Heidhues 2007).

The empirical CVM study described here was conducted within the framework of a sub-project entitled: 'Tenure and Economic Valuation of Common-Pool Resources', which was carried out during the second phase of The Uplands Program, beginning in July 2003 and ending in June 2006. Its aim was to employ the Contingent Valuation Method to assess the social benefits accruing to a lowland community in Mae Sa watershed in Chiang Mai Province from using more sustainable land use activities in the upper parts of the watershed. Details of the study area and its background are given in the next section.

Study area and problem background

The study area was located in Chiang Mai Province and more specifically in Mae Rim, a municipality located at the lowland areas of Mae Sa watershed, a small watershed (142.2 km^2) 20 km northwest of the city of Chiang Mai (Figure 5-1). The main river running through this catchment is the Mae Sa River, which flows from the agricultural area upstream to the downstream area around Mae Rim, where it flows into the Ping River, the major river in Chiang Mai Province.

Figure 5-1: Study area and Mae Sa watershed
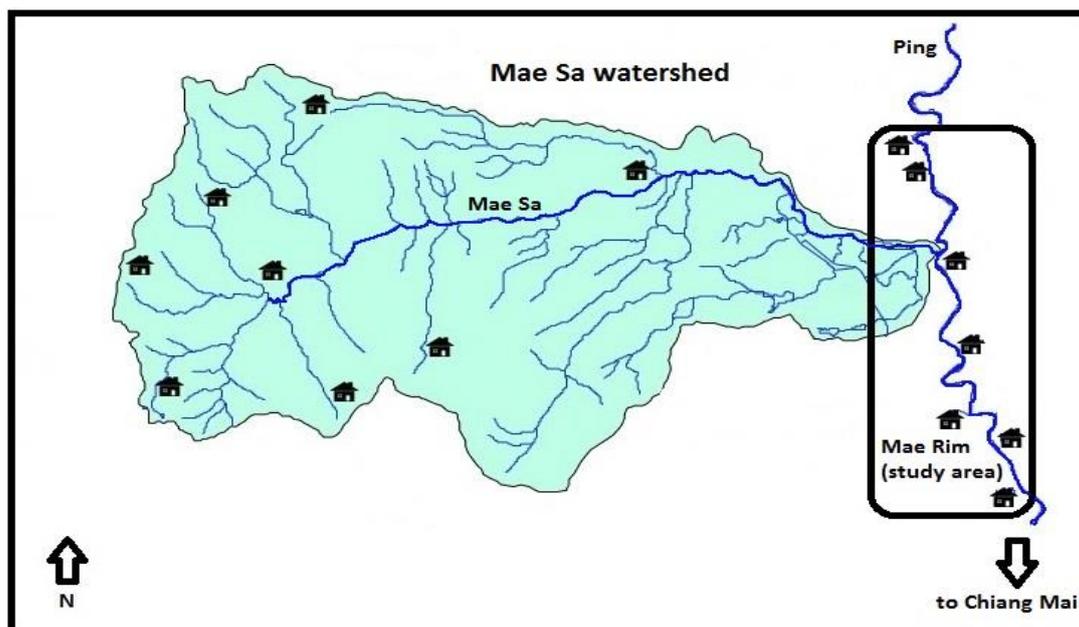
Considered a suburban area, Mae Rim has good basic infrastructure, such as roads, electricity supply, telephone and internet connections, and health care services. All households in Mae Rim have access to clean water, as nearly all villages are connected to the water distribution system managed by the Mae Rim Waterworks (MRW) –the publicly owned water service provider in the area. The MRW uses water from both the Mae Sa and Ping rivers as its main water sources, treats this water to make it of a suitable quality, then stores it in elevated tanks before distributing it to local households using gravity flow. Those villages that do not have access to the MRW distribution system have established their own village water systems – usually simple systems relying on the groundwater supply. However, the households surveyed in this study are connected to the MRW system and so use water originally taken from the Mae Sa River. For many years, these households received an inferior service from the MRW and they often experienced water supply interruptions which sometimes lasted for a few hours or even an entire day. In some areas, the tap water flows under an extremely low pressure, forcing households to buy water pumps and storage tanks. It is also the case that tap water turns red in color sometimes. Some water users even claim they sometimes suffer diarrhea from consuming the MRW's water.

There are two main reasons for the tap water problems mentioned above. The first reason is the outdated water distribution system used by the MRW, as there are often leaks and holes in the pipes which can lead to supply interruptions in certain areas, and can also lead to contamination of the water supply. The second reason is associated with the adverse effects of farming practices in the upper part of the watershed. In the upstream area of the Mae Sa valley, there are 22 Hmong and local Lanna (northern Thai) villages. The major sources of income for the inhabitants of these villages are based on agricultural activities. Local Lanna villagers earn their incomes from the production of vegetables (e.g. cabbage, paprika and chayote) and flowers (e.g. chrysanthemums). Hmong villagers earn their incomes from growing lychee fruit. Over the years, these farming activities have had a number of adverse effects upon the Mae Sa River, including 1) periodic water shortages in the river due to the large amount of water extracted for farming activities, 2) high sediment load in the river due to soil erosion, and 3) high pesticide residue levels. These issues have led to problems with the tap water quality experienced in the downstream area. For example, the periodic water shortages in the river lead to interruptions in the tap water supply among the downstream villages. Also, the high sediment load in the river leads to the tap water in Mae Rim turning red, while the chemicals in the river, many of which cannot be removed using MRW's standard water treatment methods, lead to illnesses among tap water users. In the next section, a proposed tap water improvement program, which formed

the thematic core of the practical CVM survey carried out for this study, will be described in detail.

The tap water improvement program

After many interviews conducted with local experts, two sets of measures were identified as being necessary to make the tap water of a consistently drinkable quality. These experts included scientists from the Faculty of Environmental Engineering at Chiang Mai University, the Director and technical officers of the MRW, and scientists from the Uplands Program. The first set of measures proposed was an improvement to the MRW distribution system; outdated pipes needed to be replaced and properly maintained, so as to reduce the number of supply interruptions and also the potential contamination of tap water by biological pollutants. The second set of measures included the introduction of sustainable land use practices in the upstream communities, such as use of a more locally-adapted pest control system and a soil conservation program. The plan was that this second set of measures would lead to a reduction in the chemical residue and sedimentation levels in the Mae Sa River. An important point regarding this second set of measures is that it would lead to an improvement in both private goods (in terms of the better tap water quality) and public goods. Sustainable agricultural practices were expected to result in the following public goods: (i) reduced chemical residue levels in the local ecosystems, bringing benefits to people living in the vicinity of the river now and in the future, (ii) reduced pesticide contamination of fruit and vegetables grown in the area, which would benefit consumers in general, 3) better soil quality in the uplands area, bringing benefits to the highland farmers, and 4) reduced rainfall runoff, preventing flash floods in Mae Rim and so benefiting the Mae Rim population as a whole.

5.1.2 The survey design

Two questionnaires were employed as part of the CVM survey - the CVM questionnaire and a personality inventory. The details of these two questionnaires are introduced below.

CVM questionnaire

The CVM questionnaire was developed based on feedback gained from several expert interviews, as well as two rounds of pre-tests held with MRW household members. The procedure proposed by Arrow et al. (1993) was strictly followed to minimize potential bias induced by the questions. The questionnaire was first developed in English and at a later stage

translated into Thai, with the use of language carefully adjusted to fit the suburban context around Chiang Mai, where a high proportion of people have a relatively low level of education (see section 5.2.1). Following the standard CVM questionnaire format described in chapter 2, the questionnaire used in the survey consisted of four main parts: warm-up questions, scenario description, WTP elicitation questions, and socio-economic and attitudinal questions (a full version of the questionnaire is shown in Appendix 1).

The first part of the CVM questionnaire contained warm-up questions, the aims of which were to: (i) create a good interview atmosphere and build the confidence of the respondents, so that they would feel more comfortable when answering the questions, (ii) activate respondents' memories with respect to their household water supply and their water consumption activities, and (iii) obtain specific information regarding domestic water sources and water use. The warm-up questions inquired about the sources of water, the uses the water was put to and any problems encountered with the domestic and drinking water supplies. Survey participants were also asked to describe their monthly water consumption expenses.

The second section of the questionnaire contained the most important element: a description of the project scenario. In this section, verbal descriptions as well as photographs were used to provide details about the proposed tap water improvement program to the survey respondents. The scenario description presented in the survey can be seen in Box 5-1.The project description began with an introduction of the tap water improvement program, the organizations involved in it, and the major aim of the program - which was to provide an uninterrupted drinking water supply to MRW water users. Here, the names of any public authorities involved were eliminated to create a project scenario credible to the MRW water users and to minimize the chances of respondents giving protest answers.[25] Under the project scenario, the tap water improvement program was called the "Drinkable Tap Water – Clean Stream" program. This title was developed somewhat as a gimmick to make it stand-out from other programs that the respondents may have heard of.[26] It was also expected that the title

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[25] During the pre-test of this scenario, the public authorities in Thailand seemed to have a low level of credibility among Mae Rim residents. Most if not all public investment projects were believed to be executed at inflated costs to give opportunities for corruption to take place among high-ranking civil servants and/or politicians. In the pre-test, respondents revealed their preference that the proposed program should be exclusively managed by the MRW, which is a state-owned enterprise. State-owned corporations in Thailand are operated as commercial enterprises, but still have public policy objectives. Most of them have a very good reputation among the Thai population.

[26] It was detected during the pre-test that respondents sometimes confused this tap water improvement program with other programs implemented by different organizations.

would remind respondents that the proposed project not only dealt with private goods, i.e. improved tap water quality, but also public goods, i.e. improvements of environmental quality of the upper part of the valley. At this point, these two objectives, to improve the MRW's water distribution system and environmental quality in the upper part of the watershed, were described in more detail. In addition, photographs illustrating the two sets of measures and map of the watershed were given to the respondents (see Appendix 1). Ultimately, the benefits to be generated by the program were clearly stated.

Box 5-1: Scenario description to customers during the survey

Chiang Mai University, the University of Hohenheim and the Mae Rim Water Works (MRW) company are currently surveying water users' level of interest in the program "Drinkable Tap Water-Clean Stream". The idea is that all MRW customers should enjoy an uninterrupted supply of tap water which is also drinkable.

"Drinkable Tap Water-Clean Stream" consists of two main programs which are: (i) an improvement to the MRW distribution system and (ii) an improvement in upstream water quality - as the source of the MRW's water.

INT.: Show photograph card

Improvements to the MRW distribution system are necessary due to pollution ingress - with biological pollutants entering the supply in the area due to broken pipes. Biological pollutants can cause diarrhea and other diseases. The broken pipes are also responsible for frequent interruptions in the water service in some parts of Mae Rim.

An improvement of upstream water quality is necessary to ensure that the MRW receives good water, both for treatment and distribution purposes. There are two main problems regarding the upstream water quality, the first being the red color of the water, something which occurs regularly in the wet season, and the second, contamination with pesticides which can lead to severe health problems such as cancer. The red color of the water is caused by soil erosion in the upper reaches of the Mae Sa valley, while pesticides in the water are a consequence of high usage levels there. As you can see from this map, your tap water is sourced entirely from the rivers of the Mae Sa valley.

The program "Drinkable Tap Water-Clean Stream" could be implemented in the following ways: (i) the pipeline system could be mended and maintained so that biological pollution and water supply interruptions stop, (ii) an effective soil conservation program could be implemented so that soil erosion is stopped in the upland areas, and (iii) pesticide use in the upland areas could be reduced; for example; by employing an adapted and targeted pest control system.

If these proposed measures are carried out, additional benefits will flow to the whole population of Mae Rim. For example, it is well known that progressive soil erosion in the uplands has led to sedimentation in the lowlands and, as a consequence, to a high risk of flooding in the wet season. Stopping soil erosion in the uplands due to the actions of this program will therefore reduce the risk of flooding in the Mae Rim area. Similarly, this program would also reduce the contamination of fruit and vegetables with pesticides. Furthermore, the accumulation of pesticides in the surrounding ecosystems would be stopped, so that future harm to plant and animal life would be prevented and the health of future generations not threatened by such pesticides. Therefore, the proposed measures will benefit the whole population of Mae Rim, both now and into the future, should this project go ahead.

The third part of the CVM questionnaire contained a payment scenario and an elicitation question. With respect to the payment scenario, survey respondents were told that the implementation of the proposed project had not yet been decided and that only after financing of the project had been secured would the project be implemented (the implementation rule). It was also clearly stated that all households receiving their water supply services from the MRW would be required to contribute to the program via a surcharge on their MRW water bill for the next five years if the program were eventually carried out. On top of that, it was explicitly stated that after implementation of the project, the surcharge on the water bill would be the same for all households

connected to the MRW pipe system (the payment rule). The exact wording of the hypothetical payment scheme was as follows:

"Since these measures are costly their financing has to be secured before such a program can be implemented. Therefore, it is intended to introduce a monthly surcharge on the MRW water bill for the next five years to get the program started. The surcharge will be equal for all households connected to the MRW system."

Next, the survey participants were asked to state their willingness to pay for the improvements in their household tap water quality. In the survey, the dichotomous choice (DC) and payment card (PC) formats were employed. Those respondents confronted with the DC question format, were asked:

"Would you be willing to support this program if your household had to pay… Baht per month for the next five years?"

If a respondent agreed to pay for the next five years, he or she was asked about a higher cost WTP bid:

"If it turns out that this program would cost your household … Baht instead, would you also be willing to support the program?"

If a respondent refused to pay the first bid, he or she would be asked to consider a lower WTP bid. In the survey, four different bid levels were randomly assigned to each respondent (see Table 5.1), introducing a level of variety to the bid variables in the utility difference model (i.e. t_h in equation 2-32, section 2.3.2).

Table 5-1: Bid design of the DC question format (in Baht)

First bids	Second bids (lower)	Second bids (higher)
50	25	100
100	50	200
200	100	400
400	200	800

Those respondents who were confronted with the PC question format were asked to select a range indicating a different WTP pricing option (see Box 5-2).

Box 5-2: PC question format

We would now like to ask you how much money you would be willing to contribute to the program if there was a monthly surcharge. Please select from the following list of payment categories the one that contains the highest amount you would be willing to pay per month for the next five years.					
A	0 – 5 Baht	J	71 – 85 Baht	S	321 – 360 Baht
B	6 – 10 Baht	K	86 – 100 Baht	T	361 – 440 Baht
C	11 – 15 Baht	L	101 – 120 Baht	U	441 – 530 Baht
D	16 – 20 Baht	M	121 – 150 Baht	V	531 – 650 Baht
E	21 – 35 Baht	N	151 – 180 Baht	W	651 – 800 Baht
F	36 – 40 Baht	O	181 – 210 Baht	X	801 – 1,000 Baht
G	41 – 50 Baht	P	211 – 240 Baht	Y	1001 – 1,500 Baht
H	50 – 60 Baht	Q	241 – 280 Baht	Z	1501 – 2,000 Baht
I	61 – 70 Baht	R	281 – 320 Baht	A	over 2,000 Baht

The final section of the CVM questionnaire contained questions related to the attitudes and socio-economic characteristics of the survey participants. Attitudinal questions focused on eliciting respondents' attitudes with respect to the financing of various public goods in society, their hometown, the role of the government in environmental protection, and the importance of money for their well-being. Respondents were also asked to rate their level of satisfaction on a number of life topics, such as health, work and free time, their economic situation in comparison to other households, and their concerns about a variety of private and social issues (including health, income levels, environmental degradation and corruption).The questions eliciting socio-economic and demographic information were asked after the attitudinal questions.

Personality inventory

It was mentioned before that nowadays there are Big Five inventories from which researchers can select. However, only four stand out from the others, namely the two NEO questionnaires (NEO-PI-R and NEO-FFI), the 100 Trait Descriptive Adjective (TDA), and the Big Five Inventory (BFI).The present study employed the NEO-FFI for two reasons. First, other than being the "best-validated Big Five measures" (John and Srivastava 2001, p. 115), the NEO

questionnaires were developed based on Costa and McCrae's Big Five framework (Costa and McCrae 1992), the same framework that provided the theoretical foundation for this study's hypotheses. Therefore, it seemed appropriate to employ the NEO-FFI questionnaire to measure the five personality domains. Second, the NEO-FFI contains a relatively small number of question items in comparison to other inventories such as the NEO-PI-R (240 items) or the 100TDA (100 items). Though the BFI contains less items (44), the NEO-FFI inventory was developed based on a different line of Big Five research (John and Srivastava 2001). In this study, the NEO-FFI was translated into Thai, using words that are adjusted to fit the relatively low level of education of people in Mae Rim (see section 5.2.1). The question items included in the NEO-FFI are shown below. Note that in Figure 5-2, the NEO-FFI's questions are grouped according to the domains they are designed to measure. In the survey, these items were ordered differently, in order to make the patterns underlying the items unclear to the survey participants. Also, in the survey respondents were given an answer sheet on which they could mark their response on a 5-point Likert scale, ranging from "strongly agree" to "strongly disagree".

Figure 5-2: The NEO-FFI

"The following questionnaire contains 60 statements. I will read each statement out loud to you. After each statement is read, please mark the response that best represent your opinion. Please make sure that your answer is in the correct box. Your answers to this questionnaire will be used in a related study and will be treated confidentially."		
	No.	**Question items**
Neuroticism	**N1**	I am not a worrier (r[*])
	N2	I often feel inferior to others
	N3	When I'm under a great deal of stress, sometimes I feel like I'm going to pieces
	N4	I rarely feel lonely or blue (r)
	N5	I often feel tense and jittery
	N6	Sometimes I feel completely worthless
	N7	I rarely feel fearful or anxious (r)
	N8	I often get angry at the way people treat me
	N9	Too often, when things go wrong, I get discouraged and feel like giving up
	N10	I am seldom sad or depressed (r)
	N11	I often feel helpless and want someone else to solve my problems
	N12	At times I have been so ashamed I just wanted to hide

	No.	Question items
Extraversion	E1	I like to have a lot of people around me
	E2	I laugh easily
	E3	I don't consider myself especially "light-hearted" (r)
	E4	I really enjoy talking to people
	E5	I like to be where the action is
	E6	I usually prefer to do things alone (r)
	E7	I often feel as if I'm bursting with energy
	E8	I am a cheerful, high-spirited person
	E9	I am not a cheerful optimist (r)
	E10	My life is fast-paced
	E11	I am a very active person
	E12	I would rather go my own way than be a leader of others (r)
	No.	**Question items**
Openness to experience	O1	I don't like to waste my time daydreaming (r)
	O2	Once I find the right way to do something, I stick to it (r)
	O3	I am intrigued by the patterns I find in art and nature
	O4	I believe letting students hear controversial speakers can only confuse and mislead them (r)
	O5	Poetry has little or no effect on me (r)
	O6	I often try new and foreign foods
	O7	I seldom notice the moods or feelings that different environments produce (r)
	O8	I believe we should look to our religious authorities for decisions on moral issues (r)
	O9	Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement
	O10	I have little interest in speculating on the nature of the universe or the human condition (r)
	O11	I have a lot of intellectual curiosity
	O12	I often enjoy playing with theories or abstract ideas
	No.	**Question items**
Agreeableness	A1	I try to be courteous to everyone I meet
	A2	I often get into arguments with my family and co-workers (r)
	A3	Some people think I'm selfish and egotistical (r)
	A4	I would rather cooperate with others than compete with them
	A5	I tend to be cynical and skeptical of others' intentions (r)
	A6	I believe that most people will take advantage of you if you let them (r)
	A7	Most people I know like me
	A8	Some people think of me as cold and calculating (r)
	A9	I'm hard-headed and tough-minded in my attitudes (r)

	No.	Question items
	A10	I generally try to be thoughtful and considerate
	A11	If I don't like people, I let them know it (r)
	A12	If necessary, I am willing to manipulate people to get what I want (r)
Conscientiousness	**No.**	**Question items**
	C1	I keep my belongings clean and neat
	C2	I'm pretty good about pacing myself so as to get things done on time
	C3	I am not a very methodical person (r)
	C4	I try to perform all the tasks assigned to me conscientiously
	C5	I have a clear set of goals and work toward them in an orderly fashion
	C6	I waste a lot of time before settling down to work (r)
	C7	I work hard to accomplish my goals
	C8	When I make a commitment, I can always be counted on to follow through
	C9	Sometimes I'm not as dependable or reliable as I should be (r)
	C10	I am a productive person who always gets the job done
	C11	I never seem to be able to get organized (r)
	C12	I strive for excellence in everything I do

*Negatively worded question items

5.1.3 Practical realizations of the survey

Sample selection

As previously stated, the households interviewed in this study were those connected to the MRW system, receiving their tap water exclusively from the Mae Sa River. These households were of interest because they were being directly affected by agricultural practices in the upper part of the valley. Households which were obtaining their tap water from the Ping River were not suffering the negative impacts of the upland population's activities so were excluded from the study. To identify the respondents for this study, a complete list of MRW water users was employed. From this list it became apparent that the MRW categorizes its water users according to the eight distribution systems that all its water users are connected to. In total, 4,500 households connected to five pipelines were identified as using water from the Mae Sa River and so they were chosen as the study population for this survey.

From these 4,500 households, the sample used for the survey was randomly selected using a two-step sample selection process. For the first step, a stratified sampling method was employed, because the sub-populations within the study population varied considerably. As mentioned above, the 4,500 MRW households were located alongside five distribution pipes, those delivering water to different neighborhoods with very different socio-economic

characteristics. For instance, one of the five distribution pipelines provides tap water to the residential area around military barracks, while another pipeline serves an area used as accommodation for the 1995 Southeast Asia Games, and now occupied mainly by government officials and their families. This meant that the five distribution pipelines represented very well the five strata from which a survey sample should be chosen. Using the stratified sampling strategy for this survey, households in each stratum were independently sampled based on their frequency relative to the total population in order to ensure that each stratum was well represented by the sample. To select households from each stratum, the second step of the sampling procedure, a systematic sampling method was employed. Using the systematic sampling method ensured that all households in each stratum had the same probability of being selected. During this step, MRW water users connected to each of the five distribution lines were arranged according to their meter number, then these households were selected at regular intervals throughout this ordered list. In the end, out of 4,500 households that were utilizing water from the Mae Sa River, 570 households, or 12.6% of the target population, were randomly selected for the empirical survey. A split sample design was then used, in which 345 interviews were conducted using the DC elicitation format and 225 interviews were conducted employing the PC elicitation format.

Interviews

The survey interviews were carried out between December 2004 and September 2005. In total, 87 interviewers were recruited, all of whom were master's degree students from Chiang Mai University. After being recruited, the interviewers were familiarized with the questionnaires and the interview procedures, the details of which will be described in the following section. At the beginning of each interview, interviewers were instructed to give a brief introduction to the interviewees regarding the institution responsible for the survey, the overall objectives of the survey, and the time that would be needed for the interview. Interviewers were asked to interview only household heads, or the person who was in control of the household budget. During the scenario presentation, interviewers were instructed to visualize the scenario by producing: 1) a map of the areas currently receiving MRW services, and 2) a mini-brochure describing the program "Drinkable Tap Water – Clean Stream", which included photos of broken pipes, soil erosion, red-colored river water, and details regarding pesticide application practices (see Appendix 1 for an example of the brochure). When asking respondents the WTP questions, interviewers were instructed not to lead the respondents based on their or others'

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attitudes towards MRW, and to be neutral in their body language. At the end, when respondents were asked sensitive questions regarding their level of education or their household income levels, interviewers were asked to produce the answer sheet containing different income intervals, so that respondents could give their answers in private. Interviewers were also asked to record the time it took respondents to complete the CVM questionnaire.

After the main questionnaire had been completed, interviewers were instructed to ask respondents whether or not they were willing to participate in an extra, yet related study. If the answer was yes, interviewers were asked to give a brief introduction on the purpose of these extra questions. Thereafter, interviewers were asked to read the NEO-FFI questions out loud to the respondents, who could mark their answers down on an answer sheet. This procedure was useful, since many of the question items used in the NEO-FFI were rather personal, such as "*I always feel that I am inferior to other people*". In general, it took respondents approximately 10 to 15 minutes to complete the NEO-FFI.

5.2 Results

The empirical results of the survey were split into three main categories and presented in turn. Section 5.2.1 describes the basic results of the CVM surveys, i.e. the socio-economic and demographic information provided by the household sample, section 5.2.2 assesses the measurement quality of the NEO-FFI and offers a detailed analysis of the relationship between the Big Five and the WTP statements. Section 5.2.4 contains a discussion of the results.

5.2.1 Basic results

The socio-economic characteristics of the households covered in this section are gender, age, household size, education and income of the survey respondents, as these are often found to be the most important WTP determinants and so can be used to check the plausibility of the WTP statements obtained during the empirical CVM survey (for a more detailed description of the household sample see Ahlheim et al. (2010)). In general, the gender of the respondents was equally distributed. Out of the 570 total interviews, approximately half (54%) were conducted with male respondents, and all of the respondents interviewed identified themselves either as the household head or as a person who made the key decisions on household spending. Respondents were mostly middle-aged, i.e. in their 40s (40.53). The actual age range of the respondents was rather wide being between 18 and 80 years. Two respondents under 18 were

eliminated from the dataset. On average, the selected households consisted of three family members, which is quite close to the average taken from the official household data for Chiang Mai Province[27], at 2.9 members per household (NSO 2007). The average monthly income of the sampled households was 16,618 Baht per month (equivalent to 415€ with a conversion rate of 40 Baht per 1€). These income figures are a little higher than those for Chiang Mai Province as a whole, which is 14,389 Baht per month (359€) (NSO 2007). Since Mae Rim is one of the most developed districts in the province, this would seem reasonable. The primary source of drinking water in 90% of the sampled households sample was bottled water, and the average monthly expenditure of these households on this water was around 100 Baht. Information collected from the survey on age, household size, income levels, and the monthly expenses on bottled water, is summarized in Table 5-2.

Table 5-2: Age, household size, incomes and monthly expenses on bottled water of the respondents and their households

Variables	N	Average	Std. Dev.
Age	568	40.53	11.44
Family size	523	3.19	1.49
Income	568	16,618.63	13,130.80
Bottled water	568	107.59	84.37

Also of interest was the level of education of the survey respondents. It can be seen from Figure 5-3 that only 37% of the survey participants said they had a university degree (Bachelor's or Master's). However, the majority of the survey participants, i.e. approximately 60%, had received a level education lower than a university degree.

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[27] Since no records of the socio-economic and demographic characteristics of households using water from MRW were available, this study had to evaluate the sample's representativeness by relying on the socio-economic and demographic data taken from Chiang Mai households.

Figure 5-3: Level of education of the respondents
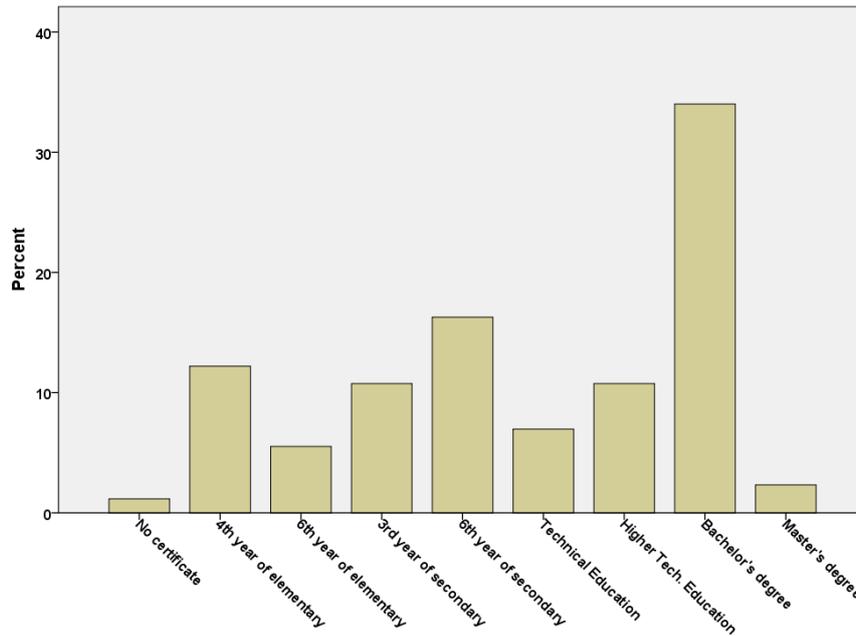
5.2.2 Practical application of the NEO-FFI survey inventory

In this section, the practical application of the NEO-FFI survey inventory within the empirical CVM survey will be discussed. The section begins with an evaluation of the reliability and validity of the inventory, when it will be shown that many of the NEO-FFI question items performed poorly. To check if these poorly functioning items were specific to the study sample, they were compared with other studies that had assessed the level of performance of the NEO-FFI. Similarities between the problematic items in this study and in other studies indicate that item content rather than socio-cultural differences, accounted for the poor performance of these NEO-FFI items. The processes of how to extract meaningful personality scores from the NEO-FFI will be discussed at the end of this section.

Evidence of the reliability and validity of the NEO-FFI

Reliability in this respect refers to the internal-consistency reliability, or the degree to which a set of items measures a single latent construct. The most common indicator of the internal-consistency reliability is Cronbach's alpha. The underlying logic behind Cronbach's alpha is that question items eliciting the same construct must be correlated. The higher the correlation, the stronger the evidence that the items are measuring the same construct. The alpha coefficient ranges from 0 to 1, with 1 meaning that there is a perfect correlation among question items, and

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0 meaning that there is no correlation among question items and that each relevant item assesses totally different psychological constructs (Shevlin et al. 2000). For a set of question items designed to measure a construct, alpha coefficients ranging from 0.50 to 0.80 represent a sufficient degree of internal consistency (Switzer et al. 1999). Alpha coefficients for the NEO-FFI used in this study are shown in Table 5-3.

Table 5-3: Alpha coefficients of the NEO-FFI

Domains	Alpha coefficients	N
Neuroticism	0.757	568
Extraversion	0.561	568
Openness to experience	0.436	568
Agreeableness	0.717	568
Conscientiousness	0.702	568

From Table 5-3, it can be seen that the alpha coefficients of the items measuring neuroticism, agreeableness and conscientiousness were safely above the desired consistency level. Question items related to extraversion and openness to experience; however, showed a rather low level of estimated reliability. This suggests that extraversion and openness to experience might not have been measured well.

Next, the evidence for construct validity of the NEO-FFI is presented. Construct validity refers to the extent to which an inventory measures the theoretical construct it is designed to measure. In practice, the construct validity of an inventory can be tested by conducting item factor analysis and checking if the factors representing the targeted constructs can be satisfactorily recovered from the dataset. For this purpose, responses to the NEO-FFI were factor analyzed using a factor extraction method known as the 'generalized least square method'. This is a type of exploratory factor analysis (EFA), a broad category describing a set of factor analysis techniques whose aim is to reveal the latent and unknown structure of a dataset.[28] Costello and Osborne (2005) warned that the implementation of EFA techniques involves a number of

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[28] EFA is often confused with principle component analysis (PCA), which is primarily a data reduction method. The PCA simplifies information from a set of variables and reduces it into a few components. The PCA is not a true method of factor analysis, as its computation does not take into account any underlying structure caused by latent variables. During the process of data reduction, PCA takes into account all types of variance of a variable. It does not make a crucial distinction between the shared, unique and error variance of a variable. EFA partitions the shared variances of a variable from the unique and error variances during the factor extraction process. Therefore, EFA is able to reveal the underlying factor structure based on shared variance information (Fabrigar et al. 1999).

methodological decisions, all of which can substantially distort the outcomes of an analysis, so they produced guidelines for conducting EFA, which are adopted in this study.

When it comes to the EFA, an important methodological decision is the number of factors to be extracted from the dataset. In practice, it is quite common that this decision is made on the basis of the Kaiser criterion, as it is the default in most statistical software packages (Costello and Osborne 2005). The Kaiser criterion suggests to extract and retain all factors whose eigenvalue[29] are greater than 1. However, Costello and Osborne (2005) pointed out that this criterion often leads to the over-extraction of factors, and so should not be used. Consequently, these authors suggested the use of a scree test, which is employed that in this study. A scree test involves an examination of a graph containing eigenvalues, as well as the identification of the point at which the curve starts to flatten. This point indicates the number of factors that should be extracted and retained. Figure 5-4 shows the scree plot for the results of this study.

Figure 5-4: Scree plot of eigenvalues (N=568)

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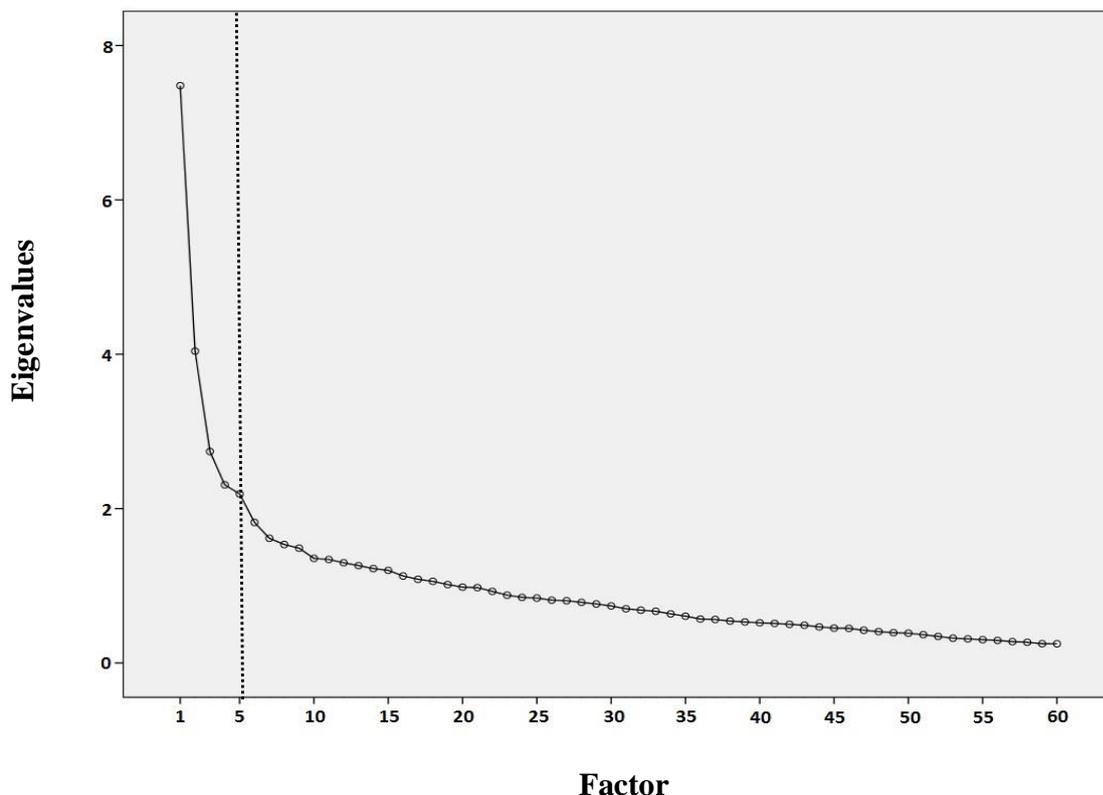
[29] Eigenvalues indicate the explanatory power of extracted factors. An eigenvalue of more than one means that the factor explains variances in the data more than any single variable does.

In Figure 5-4, the graph's x-axis represents the 60 factors that can be extracted from the 60 question items of the NEO-FFI, while the y-axis shows the eigenvalues of each extracted factor. The curve slopes downwards indicating that each factor extracted accounts for less and less of the variance in the test. It can be clearly observed that the last big drop occurs between the fifth and sixth factors, implying that the sixth factor has significantly less explanatory power than the fifth. This indicates that only the first five factors should be extracted. This result suggests that five factors can explain the latent structure of this dataset. This result, however, is still not sufficient to confirm **hypothesis 1**, which stated that respondents possess a personality structure that is consistent with the Big Five. The five factors that emerged from the dataset still have to be tested whether they have semantic meanings that correspond to the Big Five personality domains. For this purpose, the dataset is factor analyzed and five factors are extracted and rotated using the Varimax method, as it is the most commonly applied rotation technique (Costello and Osborne 2005). Factor loadings between the NEO-FFI items (re-ordered for ease of reading) and the five extracted factors are shown in Table 5-4.

Table 5-4: Item factor analysis of the NEO-FFI

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
N1	-.01	**.35**	.07	-.08	.19
N2	-.14	**.36**	-.25	.07	.00
N3	.28	**.57**	-.17	.01	-.08
N4	-.12	**.31**	.02	-.17	.18
N5	-.02	**.51**	-.28	-.03	-.06
N6	-.09	**.44**	**-.35**	.09	-.05
N7	-.12	**.47**	.08	-.16	.14
N8	.11	**.34**	-.23	-.10	-.07
N9	.08	**.57**	-.06	.07	-.07
N10	-.20	**.43**	-.06	-.06	.19
N11	.06	**.49**	-.14	.18	-.04
N12	-.10	**.41**	**-.32**	.00	-.04
E1	-.06	-.00	-.04	**.51**	.00
E2	.19	.09	.06	**.40**	.00
E3	.14	-.09	.23	.18	.28
E4	**.34**	.04	.11	**.48**	.12
E5	.10	-.07	-.12	**.40**	.05
E6	-.17	-.06	.24	.13	.13
E7	**.42**	-.25	-.22	.21	.02
E8	**.46**	-.01	.12	**.40**	.11
E9	.23	-.06	**.38**	.12	.11
E10	.17	.08	**-.40**	.14	.03

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
E11	**.49**	-.07	-.08	.19	.08
E12	-.21	-.08	.10	-.08	.04
O1	-.06	.21	.06	-.01	.04
O2	-.05	-.13	.02	-.16	.26
O3	**.33**	.15	.00	.21	**.32**
O4	.11	-.14	.02	-.10	**.36**
O5	.02	-.03	.07	.11	.28
O6	.22	.06	-.09	.16	.15
O7	.03	-.10	.08	-.22	**.30**
O8	-.01	-.15	-.13	-.26	.13
O9	.25	.05	-.08	.17	**.43**
O10	-.04	.05	.09	-.00	.26
O11	**.54**	-.02	.06	.06	.20
O12	.15	.10	-.09	.15	**.35**
A1	**.36**	.07	**.33**	.13	-.11
A2	.07	-.16	**.51**	.13	-.01
A3	.13	-.20	**.52**	-.05	.04
A4	**.32**	.10	.22	.15	.00
A5	.14	-.20	**.34**	-.04	.10
A6	-.07	-.19	**.32**	.01	.24
A7	**.35**	-.14	.18	**.33**	-.15
A8	.22	-.24	**.41**	.01	.12
A9	-.17	-.07	**.48**	.09	-.02
A10	**.38**	.12	**.36**	.18	.07
A11	-.08	-.08	**.43**	.05	.08
A12	.13	-.04	**.45**	-.12	-.09
C1	**.32**	.06	**.36**	-.01	-.26
C2	**.47**	-.09	-.01	.02	.04
C3	.27	-.08	**.46**	-.20	-.09
C4	**.62**	-.00	.23	-.14	-.02
C5	**.65**	-.00	.11	-.01	-.05
C6	.03	**-.35**	.29	-.16	.04
C7	**.56**	-.05	-.01	.05	-.11
C8	**.50**	-.02	.18	.10	.12
C9	.07	-.27	**.35**	.02	.16
C10	**.54**	-.04	.03	.05	.08
C11	.23	-.12	**.45**	-.09	-.01
C12	**.31**	-.09	-.24	.11	.02

Note: Generalized least squares: Varimax. N=568 subjects. KMO= 0.818, Bartlett's test (p<0.001).
Factor loadings ≥ 0.30 are in bold and underlined

Now, it must be checked if the semantic meanings of the extracted factors in Table 5-4 corresponded to the Big Five. The semantic meanings of the factors were derived from the content of the question items loaded on to them, and that factor loadings were accepted as meaningful if equal to or greater than 0.30. From this it follows that the meaning of factor 1 reflects that of four domains: extraversion, openness to experience, agreeableness and conscientiousness. This is due to the fact that the items designed to measure these four domains loaded predominantly on this factor. Nonetheless, the key to the identification of these factors is the content of the items with the highest loadings (Kline 2008). The three items that had the highest loadings on factor 1 were C4, C5 and C7: "*I try to perform all the tasks assigned to me conscientiously*", "*I have a clear set of goals and work toward them in an orderly fashion*", and "*I work hard to accomplish my goals*". On top of that, most of the items that loaded on factor 1 were designed to measure conscientiousness (8 out of 18), so although not in a perfectly clear way, factor 1 should be labeled as **conscientiousness**.

Factor 2 clearly represented **neuroticism**, as all question items designed to measure neuroticism loaded on this factor. Although N6 and N12 also had high loadings on factor 3, they were only their secondary loadings. The primary loadings for these two items were on factor 2. One can notice that factor 2 also contained a negatively worded item designed to measure conscientiousness (C6), that is: "*I waste a lot of time before settling down to work*". This item loaded negatively on factor 2, implying that this factor had characteristics in opposition to what it was meant to measure. This means that factor 2 was associated with procrastination. This makes sense as factor 2 represents neuroticism.

The content of factor 3 was determined using question items designed to measure neuroticism, extraversion, agreeableness and conscientiousness. However, the three items that loaded highest on this factor were negatively worded items designed to measure agreeableness (A2, A3 and A9), these being: "*I often get into arguments with my family and co-workers*", "*Some people think I'm selfish and egotistical*" and "*I'm hard-headed and tough-minded in my attitudes.*" Furthermore, ten out of the eighteen items that loaded on this factor were agreeableness-related items. For these reasons, factor 3 should be interpreted as **agreeableness**, though it should be kept in mind that the content of this factor does not perfectly reflect that of the agreeableness domain.

Factor 4 represents **extraversion**. In the study, this factor contained five out of the twelve extraversion items, these five question items being: "*I like to have a lot of people around me*", "*I laugh easily*", "*I really enjoy talking to people*", "*I like to be where the action is*", and "*I am a cheerful, high-spirited person*". Factor 4 contains one item from another domain, i.e. A7: "*Most*

people I know like me". However, this makes sense, as this item implies an aspect of extraversion, that is, the ability to form close relationships with others. It should be mentioned that factor 4 only moderately reflected the meaning of extraversion, because most of the extraversion items did not measure the latent trait they were supposed to measure. They either loaded on the wrong factors (E7, E9, E10 and E11) or did not load significantly on any of the five extracted factors (E3, E6 and E12).

Factor 5 should be labeled **openness to experience**, as all of the 5 question items loading on this factor were designed to measure openness to experience, these being O3, O4, O7, O9 and O12: "*I am intrigued by the patterns I find in art and nature*", "*I believe letting students hear controversial speakers can only confuse and mislead them*", "*I seldom notice the moods or feelings that different environments produce*", "*Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement*", and "*I often enjoy playing with theories or abstract ideas*". Factor 5 did not contain items measuring other personality domains. It should be mentioned that seven openness items did not load on this factor.

To sum up, the latent factor structure underlying responses to the NEO-FFI consisted of five factors whose meanings satisfactorily correspond to the Big Five. Based on this finding, it does not seem justified to reject **hypothesis 1**, which stated that respondents possess a personality structure that is consistent with the Big Five. Consequently, the usefulness of the BFM in the context of CVM can be further evaluated. In section 5.2.3, it will be analyzed whether there is a systematic relation between the big five personality domains and WTP statements.

Before going to the next section, problematic items of the NEO-FFI should be investigated in more detail. Results from the item factor analysis showed that many question items related to extraversion, openness to experience, agreeableness and conscientiousness did not measure what they were designed to. This is in spite of the fact that all NEO-FFI question items were interpreted into Thai, using the language that fits the suburban context of Mae Rim, where the majority of people have a relatively low level of education. In total, 20 NEO-FFI items either loaded on the wrong factor or did not load on any of the five factors. The majority of these 20 items also functioned poorly in other studies. This implies that the content of these items, rather than the samples or the socio-cultural settings of the studies, accounts for the poor performance. Table 5-5 displays the poorly functioning items in the Mae Rim sample and the poorly functioning items in eight published studies of the NEO-FFI inventory, as reviewed by Hull et al. (2010).[30] The

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[30] These eight published studies reported on the factor structure of the NEO-FFI from surveys in eight different countries: Canada, the Czech Republic, Jamaica, Japan, Poland, Slovakia, the United Kingdom and the United States.

table shows that the results reported in Hull et al. (2010) were, to a certain extent, similar to those of this study. Except for items measuring conscientiousness[31], 57-100% of the items that did not perform well in the Mae Rim sample did not perform well in other studies which used the NEO-FFI.

Table 5-5: Poorly performing NEO-FFI items

Domains	Mae Rim sample	Poorly performing items reported by Hull et al. (2010)	Percentage
Neuroticism	None	N10	-
Extraversion	E3, E6, E7, E9, E10, E11, E12	E6, E7, E10, E11, E12	71
Openness	O1, O2, O5, O6, O8, O10, O11	O1, O2, O4, O6, O7, O8	57
Agreeableness	A4, A7	A1, A2, A4, A6, A7, A10	100
Conscientiousness	C3, C6, C9, C11	None	0

Treatments of the problematic NEO-FFI items

In this study, responses to the NEO-FFI items that did not function well (i.e. those 20 items that either loaded on the wrong factor in the item factor analysis, or did not load on any of the five factors) were excluded from the computation of the Big Five personality scores in an attempt to maximize the internal-consistency reliability and the construct validity of the personality scores. The NEO-FFI is comprised of a fixed set of question items that have shown validity and utility in a variety of contexts and cultures (McCrae et al. 2004). Nevertheless, in contexts where the application of some NEO-FFI items turned out to be problematic, excluding the poorly performing items from the analysis meant the measurement of the five personality domains would be less prone to error than when including them. This is important because only if the five personality domains are reliably measured, can the resulting data be used as input into empirical models to test the relation between personality and stated WTP. Items discarded from the analysis in this study are listed in Table 5-6.

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[31] Out of the four poorly performing conscientiousness items in this study (C3, C6, C9 and C11), all involved negatively worded questions, suggesting that the Mae Rim respondents may have encountered particular difficulties when attempting to answer negatively-worded conscientiousness questions.

Table 5-6: Items discarded from the analysis

Domains	Items
Neuroticism	None
Extraversion	E3, E6, E7, E9, E10, E11, E12
Openness	O1, O2, O5, O6, O8, O10, O11
Agreeableness	A4, A7
Conscientiousness	C3, C6, C9, C11

Having excluded some of the NEO-FFI items from the analysis, the internal-consistency reliability and construct validity of the modified personality scales had to be evaluated. With respect to the internal-consistency reliability, the alpha coefficients of the modified scales for extraversion, openness to experience, agreeableness and conscientiousness - with N=568, were 0.461, 0.414, 0.709 and 0.716, respectively (see Table 5-7). The rather low degree of internal consistency for the modified extraversion and openness to experience scales can be attributed to the fact that these constructs, which have a very broad meaning, were measured with only five question items.

Table 5-7: Alpha coefficients of the modified NEO-FFI

Domains	Alpha coefficients	N
Neuroticism	0.757	568
Extraversion	0.461	568
Openness to experience	0.414	568
Agreeableness	0.709	568
Conscientiousness	0.716	568

As to the construct validity of the 40-item NEO-FFI, item factor analysis showed that the scales measured the five personality domains effectively, though some items designed to measure neuroticism, extraversion and agreeableness still had loadings on other factors of more than 0.30. Item factor analysis results for the modified NEO-FFI are shown in Table 5-8.

Table 5-8: Item factor analysis for the NEO-FFI (20 items excluded)

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
N1	.07	-.02	**.33**	-.15	.19
N2	-.23	-.17	**.37**	.05	-.00
N3	-.18	.03	**.59**	.03	-.00
N4	.06	-.11	**.31**	-.21	.06
N5	-.26	-.02	**.52**	.01	-.03
N6	**-.32**	-.15	**.46**	.10	.00
N7	.09	-.09	**.48**	-.21	.05
N8	-.22	.12	**.33**	-.10	-.04
N9	-.10	.11	**.55**	.05	.03
N10	-.09	-.18	**.43**	-.11	.03
N11	-.12	-.05	**.51**	.18	-.00
N12	**-.31**	-.10	**.41**	.02	-.00
E1	-.01	-.07	.04	**.46**	-.01
E2	.08	.17	.06	**.34**	.15
E4	.14	.26	.04	**.56**	.20
E5	-.08	.03	-.06	**.43**	.09
E8	.11	**.37**	-.06	**.42**	.26
O3	.02	.21	.07	.15	**.59**
O4	.06	.08	-.15	-.07	**.35**
O7	.09	.02	-.09	-.21	**.31**
O9	-.04	.09	-.00	.07	**.62**
O12	.09	.06	.06	.09	**.42**
A1	**.37**	**.39**	.04	.16	.03
A2	**.51**	.13	-.17	.08	-.05
A3	**.54**	.18	-.19	-.07	-.03
A5	**.33**	.16	-.21	-.06	.05
A6	**.34**	-.07	-.16	-.04	.13
A8	**.47**	.19	-.22	-.00	.07
A9	**.52**	-.11	-.05	.10	-.11
A10	**.32**	**.38**	.10	.14	.16
A11	**.46**	-.02	-.08	-.00	.01
A12	**.41**	.19	-.04	-.11	-.09
C1	.23	**.38**	.03	.07	-.12
C2	-.03	**.42**	-.10	-.00	.11
C3	.15	**.65**	-.04	-.05	.06
C4	.02	**.70**	-.00	.00	.03
C5	-.05	**.53**	-.06	.10	.04
C7	.14	**.50**	-.05	.04	.20
C8	.01	**.53**	-.05	.08	.09
C10	-.25	**.44**	-.10	.14	.04

Note: Generalized least squares: Varimax. N=568subjects. KMO= 0.815, Bartlett's test (p<0.001).
Factor loadings ≥ 0.30 are in bold and underlined

Following the factor analysis conducted above, five factor scores had to be computed so that they can be used in further analyses. In general, there are two primary classes of creating factor scores: refined methods which require technical analyses and non-refined methods which involve non-sophisticated computing procedures (DiStefano et al. 2009). The simplest and most frequently used non-refined method involves summing raw scores of question items that load on the same factor. If some items have negative factor loadings, they are to be subtracted because they are negatively related to the factor. The advantages of this computing method lies in its simplicity and its ability to preserve the variation in the original data. For this method, average scores could be calculated. Average scores are more useful than summed scores because they can be compared across factors when there are differing numbers of question items per factor. Due to this advantage, average scores were computed. Descriptive statistics of factor scores are presented in Table 5-9.

Table 5-9: Mean, standard deviation, the minimum and maximum value of factor scores

Domains	Mean	Std. Dev.	Min	Max	N
Neuroticism	2.66	0.53	1	4	568
Extraversion	3.44	0.57	1	5	568
Openness to experience	3.30	0.52	1	5	568
Agreeableness	3.51	0.53	1	5	568
Conscientiousness	3.89	0.51	1	5	568

In the following section, the systematic relationships between the modified Big Five scores and the socio-economic and attitudinal variables of the respondents will be examined. The aim of this analysis was to investigate whether the relationship patterns that support the validity of the five personality domains would emerge from the dataset. For this purpose, Pearson correlation coefficients drawn from the individual scores of the five personality domains and a number of socio-economic and attitudinal variables were computed. The socio-economic variables selected for the analysis were the age of the respondents (AGE) and their level of education (EDU). These variables were obtained from the responses to the socio-economic questions included in the fifth part of the CVM questionnaire (see Appendix 1).

The attitudinal variables selected for the analysis were computed from the attitudinal questions included in the fourth part of the CVM questionnaire (see Appendix 1). Since each of those attitudinal questions contained several individual items, it was necessary to perform

principle component analysis (PCA) in order to reduce the dimension of those items. As previously mentioned, PCA refers to a data reduction method that summarizes the information from a correlation structure among attitudinal question items and subsequently summarizes these so-called components. The meaning of the components can be derived from the meanings of the items constituting each of them. After the PCA was performed, a large number of components were obtained. Five components were included in the analysis. ATTACH was one component obtained from question 10, which asked how strong the respondents' level of attachment was to their villages and Mae Rim. DONATION indicated the respondents' attitudes towards donations and was assessed by the question items "*I find it difficult to say no if a friend ask me a favor*" and "*It gives me a good feeling if I donate money*". BREAKPROMISE revealed respondents' attitudes towards promises and included the items "*I give promises and then I do not keep them*", "*I promise to do something although I do not want to do it*" and "*I am concerned what other people might think of me*". SATISFACTION was a component representing the respondents' levels of satisfaction towards family life, standard of living, housing, free time, and life in general. INTERESTSOCIAL indicated the level of interest the respondents felt towards various social issues, including environmental issues, public health and social justice issues. Description of the variables are summarized in Table 5-10. The correlation coefficients of the variables and the five personality domains are shown in Table 5-11.

Table 5-10: Description of the variables used in correlation analysis

Variables	Description
AGE	Age of the respondents
EDU	Level of education of the respondents
ATTACH	Level of emotional attachment of the respondents to their villages (0 = "not attached at all", 5 = "very attached")
DONATION	The tendency towards making donations and doing favors (0 = "never", 5 = "very often")
BREAKPROMISE	The tendency towards breaking promises (0 = "never", 5 = "very often")
SATISFACTION	Level of satisfaction towards various issues (0 = "not satisfied at all, 5 = "very satisfied")
INTERESTSOCIAL	Level of interest towards various issues (0 = "not interested at all", 5 = "very interested")

Table 5-11: Correlations of the Big Five with socio-economic and attitudinal variables

Variables	N coeff. (p-value)	E coeff. (p-value)	O coeff. (p-value)	A coeff. (p-value)	C coeff. (p-value)
AGE	-.120** (.004)	.010 (.813)	-.056 (.187)	.109** (.009)	.011 (.785)
EDU	-.049 (.243)	-.102** (.015)	.160** (.000)	-.014 (.735)	.088** (.036)
ATTACH	-.130** (.002)	.101** (.016)	-.023 (.580)	.030 (.478)	.018 (.677)
DONATION	.021 (.613)	.142** (.001)	.139** (.001)	.132** (.002)	.181** (.000)
BREAKPROMISE	.250** (.000)	.123** (.003)	.046 (.277)	-.163** (.000)	-.068* (.090)
SATISFACTION	-.217** (.000)	.063 (.133)	.048 (.251)	.161** (.000)	.167** (.000)
INTERESTSOCIAL	-.019 (.649)	.038 (.367)	.157** (.000)	.129** (.002)	.180** (.000)

Note: Pearson correlation. N=568 subjects. Bases for intercorrelations range from 565-568 owing to item nonresponse. ** means significance at the 5% level, * significance at the 10% level

The results of the correlation analysis reveal patterns that generally support the validity of the modified Big Five scores. To begin with, respondents who scored high on **neuroticism** gave responses to the attitudinal questions that reflected their susceptibility to negative feelings. Neurotic respondents felt less satisfied with important aspects of their lives (SATISFACTION), felt less attached to their hometowns (ATTACH) and had a tendency to make promises that they knew they would not keep (BREAKPROMISE). Furthermore, they tended to be younger than respondents with a low level of neuroticism. The respondents who scored highly on **extraversion** gave responses to the attitudinal questions that reflected their ability to form close relationships with others. Extravert respondents felt more attached to their hometowns (ATTACH) and said they find it difficult to say no when others ask them a favour (DONATION). However, it was also unlikely that they would keep their promises (BREAKPROMISE). These respondents were also less educated than the introverted respondents. **Openness to experience** was found to correlate positively with the level of education of the respondents, and as expected, open respondents were found to be more interested in various social issues than the closed respondents (INTERESTSOCIAL). **Agreeable** respondents tended to be older. They said they find it difficult to say no to others

(DONATION). But, unlike the extraverts, agreeable respondents were less likely to break their promises once they made them (BREAKPROMISE). This self-reported form of reliability was also found among **conscientious** respondents, who tended to be highly educated.

In summary, evidence regarding the internal-consistency reliability and validity of the modified NEO-FFI scores suggested that these scores measured what they claim to measure, that is, the five personality domains, and therefore they can be employed in the analysis of the relationships between the Big Five domains and the WTP statements to be conducted in the next section.

5.2.3 Effects of the five personality domains on WTP statements: Empirical evidence

The main objective of this study was to investigate the effects of the Big Five personality domains on WTP statements in contingent valuation surveys. The theoretical foundation for this investigation was developed in Chapter 4, which described how insights obtained from the Big Five model were integrated into the CVM framework and the theoretical predictions regarding the effects of each of the five personality domains on WTP statements. The empirical measurement of the domains using the NEO-FFI, as presented in the last section, resulted in domain scores which could then be used to test the theoretical predictions made previously. The results of this empirical test constitute the main content of this section.

The investigation described in this section made use of the probit and tobit regression models for the WTP decisions introduced in section 2.3.2. Based on these models, those variables that were systematically associated with the stated WTPs, i.e. the WTP determinants, could be identified. In order to test if the Big Five personality domains are a determinant of WTP statements, the Big Five scales were included as the core independent variables of the probit and tobit regression models. In addition, several socio-economic and attitudinal variables were also included in the models, for two reasons, first, so that their effects on WTP statements could be controlled, and two, so that it would be possible to check for the plausibility of the WTP statements. Plausible WTP data formed an important basis for an analysis of the relationship between personality and WTP statements, but as previously discussed, one of the main difficulties arising from the hypothetical nature of the CVM is the lack of any criterion able to be used to verify its results. By making predictions on how certain respondent characteristics would affect the stated WTP, the CVM results could be validated to a certain extent. In the following section,

the socio-economic and attitudinal variables that were included in the probit and tobit models will be introduced, and their expected influence on the stated WTPs will be discussed.

To begin with, general socio-economic variables such as the sex and age of the respondents (SEX and AGE) were expected to vary systematically with stated WTP, whereas the number of people in the household (HHSIZE) was expected to positively influence stated WTP. This was due to the fact that a household with more members would be likely to receive more benefits from an environmental project than a household with fewer members. Furthermore, respondents with a higher level of education and income (EDU and INCOME) were expected to be willing to contribute more to the tap water improvement program. The same was expected of respondents who spent more on bottled water each month (BOTTBILL), as they were likely to benefit more from the drinkable tap water. Note that the above-mentioned socio-economic variables were obtained directly from responses to the questions contained in the fourth part of the CVM questionnaire (see Appendix 1).

Unlike the socio-economic variables presented above, the attitudinal variables could not be obtained from the attitudinal questions, because each attitudinal question contained many small question items. As a result, it was necessary to conduct principle component analysis to reduce the question items' dimensions to a smaller number of factors. In total, three extracted factors were included in the probit and tobit regression models. The first factor - WORRY, represented the extent to which respondents were worried about the ailments and diseases they could contract from the consumption of contaminated tap water (such as diarrhea, kidney stones and cancer). The more respondents worried about their tap water quality, the more they could be expected to want to pay for the water improvement program. So, a positive coefficient of WORRY was anticipated. The second and third factors (BENEFIT and PROTEST) were extracted from question 8 concerning the reasons for the WTP decisions (Appendix 1), where BENEFIT referred to the various private and public benefits resulting from the program, and PROTEST represented items that assessed the respondents' views on protesting (including: "*I have severe doubts that these improvements can be realized as described*", "*I think government is responsible for such a program and should pay for it*", and "*My water costs are already high enough; we should receive the good quality service without additional costs*"). Respondents who expected more benefits from the program could be expected to contribute more; with the opposite expected of those who scored highly on the protest belief. Therefore, the coefficients of BENEFIT and PROTEST were expected to be positive and negative, respectively. Description of the variables used in this analysis are summarized in Table 5-12.

Table 5-12: Description of the variables used in regression analyses

Variables	Description
BID	Proposed WTP bids (for DC dataset)
SEX	Sex of the respondents (0 = female, 1 = male)
AGE	Age of the respondents
EDU	Level of education of the respondents
HHSIZE	The number of people in the household
INCOME	Net monthly income
BOTBILL	Average monthly expenditure on bottled water
WORRY	Level of worry about ailments from contaminated tap water (1 = "not worried at all", 5 = "very worried")
BENEFIT	Various private and public benefits expected from the program
PROTEST	Various protest belief towards the program
NEURO	Level of neuroticism
EXTRA	Level of extraversion
OPENN	Level of openness to experience
AGREE	Level of agreeableness
CONSC	Level of conscientiousness

Results of the analysis of the influence of personality on WTP statements are presented in Table 5-13 and 5-14. Tables 5-13 shows the results of the probit regression model for the DC dataset, with the WTP answers as independent variables and the five personality domains (together with the other variables introduced above) as explanatory variables. Table 5-14 exhibits the results of the tobit regression model for the PC dataset, with the midpoints of WTP intervals as independent variables. Before looking at the results in detail, it should be mentioned at the outset that the magnitude of the estimated coefficients displayed in the two tables cannot be interpreted in the same manner as normal regression coefficients (Greene 2007). This means that only the signs of the coefficients can be meaningfully interpreted, such that positive coefficient estimates indicate a positive effect of the respective independent variables on the WTP statements. Due to this reason, the marginal effects of the coefficients were also computed. They are displayed on the third column of Table 5-13 and 5-14.

Looking at Table 5-13, many variables display the expected effects on stated WTP, with the variable representing WTP bids (BID) having a significantly negative impact on WTP

answers. This result is plausible since the higher the proposed bids, the less likely it was that respondents would want to pay for them. Furthermore, age of the respondent (AGE) had a negative effect on the stated WTP. This result is in line with expectations and means that the older the respondents, the less likely they were to be willing to pay for the proposed program. This could be attributed to the fact that elderly people usually expect fewer benefits from an environmental project whose impacts are not immediate and that may only be generated in the far future. Next, the coefficients of both INCOME and BOTTBILL are significantly positive, as expected. Households with a higher level of income systematically had a higher WTP, and households with higher monthly bottled water expenses expected more benefits from the tap water improvement program, and as a result, were willing to pay more to support the program. As to the attitudinal variables, both WORRY and BENEFIT exhibited a positive association with the stated WTP, in other words, respondents who were more worried about the quality of their tap water and expected more benefits to be created by the program, were more likely to be willing to pay for it. PROTEST had a significantly negative effect on the stated WTP, suggesting that households who did not agree with the scenario tended to pay less. All in all, these effects confirm the prior expectations and confirm the plausibility of the elicited WTP.

When it comes to the effects of the five personality domains on the stated WTP, it is apparent that some of the five personality domains were statistically significant variables in explaining the systematic variations of WTP answers. More specifically, openness to experience (OPENN) had a strongly significant and positive effect on WTP answers, as did conscientiousness (CONSC) but to a lesser degree, at only a 5% level. Therefore, the first, important finding is that respondents' openness to experience and conscientiousness could explain the stated WTP levels above and beyond the controlled socio-economic and attitudinal variables. In other words, after controlling for the effects of the variables sex, age, education, number of household members, income levels, worries over water quality, reasons for the contribution, and reasons for disagreement with the project scenario, respondents' WTP statements were determined to a significant degree by their personality domains openness to experience and conscientiousness. This result supports hypothesis 4 - that respondents a high level of openness to experience are more likely to state a significantly higher WTP than respondents with a low level of openness to experience. The result, however, contradicts hypothesis 6 - that conscientiousness does not have an effect on WTP statements. In particular, the evidence here suggests that respondents a high level of conscientiousness are more likely to state a significantly higher WTP than respondents with a low level of conscientiousness.

The second important finding here is that not all five personality domains exhibited a direct association with stated WTP. More specifically, the expected relationships between neuroticism (NEURO), extraversion (EXTRA) and agreeableness (AGREE) on the one hand and the WTP answers on the other could not be confirmed by using this probit model for the DC dataset. The lack of statistical significance for the three personality domains holds true even in a reduced regression model excluding all other socio-economic and attitudinal variables. This indicates that no relationships could be detected between stated WTP and the neuroticism, extraversion and agreeableness scores, even if such a relationship was only spurious, as induced by confounding variables. As a result, on the basis of this finding it is not possible to confirm hypotheses 2, 3 or 5. These two tentative findings were further tested in the PC version of the CVM survey.

Looking at the marginal effects of the explanatory variables in the DC model, a 1000-baht increase in the WTP bids (BID) decreases the probability that the respondents will accept the bids by 144 percentage points. At the same time, a 1000-baht increase in the net monthly income (INCOME) increases the probability that the respondents will accept the proposed bids by 3 percentage points. A one-unit increase in openness to experience (OPENN) and conscientiousness scores (CONSC) will increase the probability that the respondents will accept the proposed bids by nine and fourteen percentage points respectively.

Table 5-13: Personality as explanatory variables for WTP in the DC dataset

Variables	Coeff.	p-value	Marginal effect
BID	-6.97**	0.00	-1.44
SEX	-16.45	0.90	7.71
AGE	-13.92**	0.03	-5.18
EDU	-16.21	0.66	-8.99
HHSIZE	37.20	0.42	2.45
INCOME	0.08*	0.07	0.03
BOTTBILL	3.77**	0.00	0.89
WORRY	173.79**	0.01	47.16
BENEFIT	268.52**	0.00	110.14
PROTEST	-178.56**	0.00	-39.83
NEURO	0.14	0.27	0.07
EXTRA	-0.15	0.22	-0.04
OPENN	0.26**	0.03	0.09
AGREE	0.14	0.37	0.03
CONSC	0.26*	0.05	0.14
N	345		
Modified McFadden's pseudo-R^2 (Herriges 1999)	0.08		

Note: Standard double-bounded probit model. As this model does not correspond to a pre-existent model, a log likelihood function (as shown in equation 2-32) was directly specified and maximized in Nlogit to estimate the parameters of the model. Seven independent variables were rescaled by dividing by 1000 (BID, SEX, AGE, EDU, HHSIZE, INCOME, and BOTTBILL). Marginal effect is based on the single-bounded model. ** means significance at the 5% level, * significance at the 10% level

When it comes to the tobit regression model for the PC dataset, relatively few socio-economic and attitudinal variables had a significant effect on the WTP statements (Table 5-14). BENEFIT exhibited a positive association with stated WTP. This was in line with expectations and supported the plausibility of the elicited WTP answers. Two surprising outcomes should be noted here. First, respondents from larger households (HHSIZE) had a significantly lower WTP than respondents from smaller households. This result would seem counterintuitive, but can be explained by the fact that respondents living with more household members had more household expenses. As a result, such respondents were under greater financial pressure than those living with fewer people. The second puzzling result was a missing significant income effect (INCOME) on WTP, and this is more difficult to explain. Typically, income is a reliable WTP

determinant, but in this study INCOME exhibited no influence on the relevant WTP. Had other variables in the PC model not exhibited their expected influence on the stated WTP, this absence of a significant association between income levels and WTP would have created doubt in terms of the validity of the model.

There were four key results regarding the effect of personality domains on WTP answers. The first of these was the strongly significant and positive influence of openness to experience on stated WTP in the PC regression model. This finding adds to the evidence supporting hypothesis 4 that respondents a high level of openness to experience are more likely to state a significantly higher WTP than respondents with a low level of openness to experience. Second, the finding that conscientiousness had a positive association with stated WTP was also reproduced in the PC model. Again, this result contradicted hypothesis 6 – that conscientiousness does not have an effect on WTP statements. Third, a significantly negative association between extraversion and the stated WTP was detected, which is contrary to hypothesis 3 predicting a positive association. Fourth, the absence of a significant influence of neuroticism and agreeableness on the WTP was replicated in the PC dataset.

To better understand the estimation results, the marginal effects of the explanatory variables on stated WTP were also analyzed. An increase of one household member (HHSIZE), for example, will lead respondents to reduce their stated WTP by nine baht. A one-baht increase in the average monthly expenditure on bottled water (BOTTBILL) will lead respondents to decrease their stated WTP by 0.14 baht. At the same time, a one-unit increase in openness to experience score will lead to an approximately 20-baht increase in stated WTP. A one-unit increase in conscientiousness score will also lead to an approximately 19-baht increase in WTP answers.

Table 5-14: Personality as explanatory variables of WTP for the PC dataset

Variables	Coeff.	p-value
SEX	7.97	0.40
AGE	-0.68	0.15
EDU	-0.67	0.34
HHSIZE	-8.92**	0.02
INCOME	2.46	0.55
BOTTBILL	0.14**	0.02
WORRY	-2.07	0.68
BENEFIT	15.81**	0.00
PROTEST	-2.63	0.59
NEURO	15.77	0.13
EXTRA	-20.25**	0.03
OPENN	19.80**	0.03
AGREE	0.96	0.91
CONSC	9.05**	0.06
N	213	
McFadden's pseudo-R^2	0.02	

Note: Tobit regression model. Dependent variable is the midpoint of payment card intervals. Four independent variables were rescaled. INCOME was divided by 1000. WORRY, BENEFIT, and PROTEST were multiplied by 1000. ** means significance at the 5% level, * significance at the 10% level

Taken together, the evidence shown in Tables 5-13 and 5-14 confirms **hypothesis 4**. The openness to experience domain had a significantly positive effect on the stated contributions to be made for the proposed environmental project. Since this effect occurred in both the DC and PC versions of the survey, it would seem to be a robust result. However, **hypothesis 6**, which stated that conscientiousness does not have an effect on WTP statements, have to be rejected. This is because in both DC and PC datasets, conscientiousness varied systematically with stated WTP. More specifically, conscientiousness had a significant and positive effect on WTP answers. **Hypothesis 3**, which stated that respondents with a high level of extraversion are more likely to state a significantly higher WTP than respondents with a low level of extraversion, has to be rejected, as it predicted a positive association between extraversion and the stated WTP. Evidence which refutes this hypothesis was produced by the PC version of the survey, in which respondents who scored high on extraversion had a significantly lower WTP than the low scorers. Last but

not least, **hypotheses 2 and 5** could not be confirmed on the basis of the regression results of this study. In both the DC and PC versions of the survey, neither neuroticism nor agreeableness had a significant effect on the WTP statements. Before looking into these results in more detail, the effects of the five personality domains on other CVM response behavior should be tested, those predicted based on the insights obtained from the Big Five model (section 4.3).

In total, five theoretical predictions were made in section 4.3 with respect to the relation between the five personality domains and different CVM response behavior. To start with, neuroticism was expected to be an important determinant of protest belief. Next, a positive association between extraversion and extreme response style was anticipated, because of the exaggerated communication styles of the extraverts. Last but not least, openness to experience, agreeableness and conscientiousness were expected to provide an intrinsic incentive among respondents to answer the CVM questionnaire as carefully as possible. As a result, these three personality domains were expected to positively affect the amount of time respondents used to answer the questionnaires.

To test the theoretical predictions mentioned above, three OLS regressions using differing response behavior as dependent variables were performed. The three dependent variables of interest were protest belief, extreme response style, and time used for interview. These were measured as follows. For protest belief, a "protest scale" (Meyerhoff and Liebe 2006) was calculated by summing up the ratings interviewees gave on a five-point Likert scale to three protest statements in the CVM questionnaire, these being: "*I have severe doubts that these improvements can be realized as described*", "*I think the government is responsible for such a program and should pay for it*", and "*My water costs are already high enough we should receive the good quality service without additional costs*". A higher protest score represented a stronger protest against the proposed scenario. Extreme response style was measured by counting the number of positive and negative extreme responses (Meisenberg and Williams 2008), such as "strongly agree" and "strongly disagree", that each respondent gave to all 78 question items which contained the five-point Likert scale in the CVM questionnaire. The more often he or she used the endpoints of the Likert scale, the higher the "extreme response score" each respondent obtained. Finally, to record the timings of each interview, the interviewers were asked to record the overall time each respondent needed to complete it.

The independent variables of the three regression models consisted of the Big Five scores and a set of socio-economic variables. The regression results are shown in Table 5-15, and these suggest that several of the socio-economic variables were important in determining the protest beliefs and extreme response styles of the respondents, as well as the amount of time it took them

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to complete each interview. Looking first at the determinants of the respondents' protest beliefs, the sex (SEX) and income (INCOME) coefficients were negative, meaning that those who were male and had a higher income were less likely to hold protest belief. At the same time, the education (EDU) and number of household member (HHSIZE) coefficients were both significantly positive, indicating that respondents with a higher level of education and from larger households were more likely to hold protest attitudes. EDU also had a significant and positive effect on the respondents' extreme response styles, while it had a significant and negative effect on the amount of time respondents took to complete their interviews. Average monthly expenditure on bottled water (BOTTBILL) coefficients was also significantly negative, meaning that respondents who pay more for their bottled water per month used less time to complete their interviews.

Turning now to evidence regarding the effects of the five personality domains, neuroticism (NEURO) had a significant and positive effect on protest beliefs and, unexpectedly, so did conscientiousness (CONSC). Extraversion did not seem to have any significant effect on extreme responses, instead, positive and negative effects were displayed by conscientiousness and neuroticism respectively. Ultimately, conscientiousness (CONSC) had the expected positive influence on the amount of time each respondent took to complete the interview, while extraversion (EXTRA) had a negative impact. These results will be discussed in more detail in the next section.

Table 5-15: The five personality domains as explanatory variables of interview response behaviour

Variables	Protest beliefs		Extreme responses		Time used	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
SEX	-0.57**	0.00	-0.59	0.28	-0.09	0.91
AGE	-0.00	0.28	0.00	0.50	0.00	0.86
EDU	0.11**	0.03	0.14**	0.03	-0.75**	0.00
HHSIZE	0.13*	0.08	0.00	0.49	0.44	0.23
INCOME	-0.01*	0.07	0.00	0.97	0.06	0.10
BOTTBILL	0.42	0.69	-1.95	0.55	-8.67*	0.08
NEURO	0.55**	0.00	-2.18**	0.00	-0.50	0.60
EXTRA	-0.00	0.98	-0.31	0.57	-1.60*	0.07
OPENN	-0.23	0.25	-0.39	0.51	-1.44	0.14
AGREE	0.33	0.11	-0.75	0.16	-1.21	0.21
CONSC	0.47**	0.03	3.63**	0.00	2.44**	0.02
N		472		568		471
F-value		3.15		5.21		2.49
(p-value)		0.000		0.000		0.004
Adjusted R^2		0.047		0.075		0.033

Note: Ordinary least squares. Dependent variables are three forms of CVM response behaviour. Two independent variables were rescaled by dividing by 1000 (INCOME and BOTTBILL). ** means significance at the 5% level, * significance at the 10% level

5.2.4 Discussion of the empirical results

In the preceding sections, the results of personality assessment and of all the regression models were presented. The main aim of this section, therefore, is to sum up the most important findings and discuss them with respect to the two main research questions that this study set out to explore. The first research question was whether or not respondents in the practical CVM survey conducted for this study possess a personality structure that is consistent with the Big Five. The second research question sought to determine the systematic relationship between the Big Five and stated WTP.

For this reason, the first part of the empirical analysis of this study dealt extensively with the assessment of the five personality domains. A 60-item personality inventory (the NEO-FFI) was translated into Thai, using the language that fit the socio-cultural background of suburban northern Thailand. Employing the data elicited in the main survey, the latent structure of the dataset was analyzed by means of an exploratory factor analysis. It became apparent that five factors were sufficient to explain the variance in this dataset. Analysis of the semantic meaning

of the five extracted factors revealed that their meanings corresponded satisfactorily to the Big Five. As a result, hypothesis 1 which stated that CVM respondents possess a personality structure that is consistent with the Big Five is supported and a further analysis of the systematic relationship between the five personality domains and WTP answers in CVM is warranted.

Despite the fact that the NEO-FFI could satisfactorily distinguish between the five personality factors which should theoretically be included in it, the results from exploratory analysis revealed that many of its question items did not measure what they were designed to. This finding of the present study is consistent with that of Hull et al. (2010) who also found that many items of the NEO-FFI performed poorly across various socio-cultural settings. This suggested that the items and not the samples or the cultural contexts are the source of the problem. Since the inclusion of the poorly performing items in the subsequent analysis could make the measurement of the five personality domains prone to error, responses to 20 poorly performing items of the original inventory were excluded from further analysis. The remaining empirical analysis of this first part focused on the reliability and validity of the 40-item version of the inventory. The alpha coefficients of the modified scales indicated the 40-item scale to be sufficiently reliable. On top of that, evidence of the modified scale's construct validity was documented by means of exploratory factor analysis and correlation analysis. It became clear that the 40 question items functioned well in the current sample and that they were able to actually distinguish between the five personality domains.

When it comes to the main part of the analysis, i.e. the testing of the relation between personality and WTP answers, personality scores computed from these 40 items were used in regression models to test the influence of personality on WTP statements in a CVM interview. Many interesting results were obtained from which an improved understanding of different patterns of WTP answering behavior stemming from individual differences in personality characteristics of respondents can be gained. **Neuroticism**, to begin with, exhibited no effect on WTP answers in both DC and PC regression models. Consequently, hypothesis 2 could neither be confirmed nor rejected based on the present data. This finding was unexpected and rather difficult to explain. Theoretical considerations made on the facets of neuroticism clearly suggested that this personality domain can be expected to lead to the understating of WTP. This result also differed from that reported by Soliño and Farizo (2014) who found that respondents who possess a high level of neuroticism were less likely to choose the implementation of an environmental program in a choice experiment survey. A possible explanation for the absence of neuroticism effect on WTP answers may be that the neuroticism domain is too broad a

concept to predict the statement of WTP. It is conceivable that some facets of neuroticism may produce unforeseen and contradictory effects on WTP statements.

It is possible, for example, that the facet of self-consciousness might cause respondents to overstate their WTP instead of understating it as predicted in section 4.3.1. Individuals with a high score on self-consciousness are those who are easily disturbed by awkward social situations. Because of this, self-conscious individuals might avoid embarrassing themselves by behaving according to what others deem as desirable. In the CVM context, the statement of zero or low WTP for a public environmental good is likely to trigger social disapproval (Börger 2013). As a consequence, self-conscious respondents might be more likely to overstate their WTP for the proposed environmental program independent of their valuation of it. This hypothesis is in agreement with Börger's (2013) findings which showed that CVM respondents who are afraid of social disapproval in fact tend to overstate their WTP. If self-consciousness did indeed cause the overstating of WTP, this effect could act against the effects of other facets of neuroticism and explain the lack of the neuroticism effect on WTP answers in this study. Yet, this is pure speculation and further research on the direct effect of neuroticism facets on stated WTP in CVM survey is required.

Even though the neuroticism domain might be too broad to predict WTP answers, it appeared to be at an appropriate level of abstractness when it comes to the prediction of other CVM response behavior. More specifically, neuroticism exhibited a positive effect on protest belief. This result collaborated the theoretical prediction made in section 4.3.1 and it indicated that anxious respondents were more likely to have a strong protest attitude towards the tap water improvement program than calm respondents. This finding, while preliminary, suggested that neurotics were likely to state WTP that constitutes some mix of preference evaluation and protest beliefs, which is of course not desirable from the perspective of the CVM practitioner. Furthermore, neuroticism also showed a negative relation with extreme responses. This meant that high scorers on neuroticism selected the middle response options of the Likert scales regardless of the content of the question. This result implied that neurotics might not exert enough effort into answering questions in CVM surveys. Taken together, it must be stated that even though the effect of neuroticism on stated WTP could neither be completely confirmed nor refuted, there were indications that neuroticism was a source of potential biases contained in WTP answers. Further evidence on the existence and the exact form of neuroticism's influence on WTP is therefore necessary.

When it comes to the effect of **extraversion** on stated WTP, hypothesis 3 had to be rejected. A negative association between extraversion and WTP answers was found in the PC

regression model. Extraversion had no impact on stated WTP when the DC question format was used. One potential cause of this difference in results is the relatively small sample size of the DC dataset (N=345). The DC elicitation question format requires a rather large sample size in order to produce reliable results (Arrow et al. 1993). This might contribute to the difference in results. The negative effect on WTP statements that extraversion displayed in the PC model was surprising. It contradicted both the hypothesized impact and the result reported by Soliño and Farizo (2014) who found that extraverts were more likely to prefer the implementation of an environmental program in a choice experiment survey. The reason for this discrepancy in results is quite unclear. A possible explanation might be the unforeseen negative effect of some facets of extraversion on WTP statements. Consider the possibility that the facet of positive emotions led respondents to understate their WTP instead of overstating it as predicted in section 4.3.2. Respondents with a high score on positive emotions tended to be cheerful and optimistic. Optimism, however, might cause extraverts to interpret both present and future situations in the best possible light and thus perceive the proposed tap water improvement program as unnecessary and understate their WTP as a result. This hypothesis is in line with the ideas of Loewenstein and Lerner (2003), who suggested that positive emotions discourage individuals to engage in a careful evaluation of the situation and trigger an overly optimistic judgment. If positive emotions did cause the understatement of WTP, this effect could dominate the effect of other facets and explain the negative effect of extraversion on stated WTP in PC regression model. Yet again, this is merely a possible explanation and it should be investigated in future studies.

Contrary to expectations, this study did not find a significant relationship between extraversion and extreme response style. This result differed from that reported by Harzing (2006) who hypothesized and found that extraversion was a strong determinant of extreme response styles in many surveyed countries. The reason for this discrepancy in results could stem from the different personality inventory. While Harzing (2006) employed the Eysenck Personality Questionnaire (EPQ), this study used the NEO-FFI. On top of that, the present study excluded seven extraversion items from the analysis due to their poor psychometric quality. These are potential causes of the different in results. Extraversion, however, showed a negative relation with the amount of time needed for the interview. This meant that high scorers on extraversion used significantly less time to answer survey questions. This implied that extraverts may not exert enough effort into answering questions in CVM surveys. Overall, while the positive relationship between extraversion and stated WTP had to be rejected based on the

present data, it would be premature to dismiss the idea of extraversion as a source of biases of WTP statements.

With respect to the relation between **openness to experience** and stated WTP, hypothesis 4 was confirmed. Because of their preference for and readiness to adopt novel activities, open-minded individuals were expected to obtain a bigger welfare change resulting from the environmental change scenario and consequently report a significantly higher WTP than close-minded respondents. The results obtained from regression analyses clearly demonstrated the positive association between openness to experience and stated WTP in both DC and PC regression models. This was strong evidence suggesting that respondents with a high score on openness to experience were indeed more likely to expect a higher level of welfare changes from the proposed tap water improvement program and thereby reported a higher WTP answer than respondents with a low score on openness to experience. This finding is in agreement with Soliño and Farizo's (2014) finding which showed that openness to experience positively affects consumers' preferences for an environmental program. On the basis of the evidence found in this study, it is reasonable to suggest that openness to experience is an important personality characteristic and it should be assessed in CVM surveys.

In contrast to the theoretical prediction made in section 4.3.3, openness to experience turned out not to play any role for the amount of time respondents needed to answer survey questions. As a result, the idea that openness to experience provided intrinsic incentive for CVM respondents to exert more effort into answering the survey questions could neither be rejected nor confirmed.

When it comes to the effect of **agreeableness** on stated WTP, hypothesis 5 could neither be confirmed nor refuted. This hypothesis stated that CVM respondents with a high level of agreeableness are more likely to state a significantly higher WTP than respondents with a low level of agreeableness. The current study found that agreeableness exhibited no influence on WTP statements in both DC and PC regression models. This result might be because agreeable respondents were likely to have a protest attitude towards the tap water improvement program. This relationship could be observed in the regression model displayed in Table 5-14. It should be noted, however, that while the coefficient for agreeableness was positive, the observed effect was slightly above the 10% significance level (p-value = 0.11). This protest attitude could act against the positive effect of agreeableness and explain the absence of an agreeableness effect on WTP answers. However, further work is required to establish this.

Hypothesis 6 which stated that **conscientiousness** does not affect WTP statements had to be rejected on grounds of the present data. In both DC and PC models, conscientiousness

displayed a positive influence on the amount of WTP responses. This positive association suggested that conscientious respondents had a higher preference for the proposed tap water improvement scenario than respondents who score low on conscientiousness. This might be because of the tendency to be cautious and deliberate of conscientious respondents that could enable them to obtain a complete perception of the proposed tap water improvement program and the benefits to be expected from it. Respondents with a low level of conscientiousness, in contrast, might be less careful when they form the idea of the future benefits to be expected from the project proposed and as a result obtain only a partial perception of the program and its benefits. This conjecture was supported by the finding of Frör (2008) who reported that CVM respondents who were effortful in their information processing and decision making stated a higher WTP than respondents who relied on fast and effortless decision making style.

Apart from its impact on stated WTP, conscientiousness was also found to determine the amount of time respondents used in the interview, the result which confirmed the prediction made in chapter 4 and suggested that conscientious individuals exerted more effort into considering and answering survey questions. Further, positive associations between conscientiousness on the one hand and extreme response style and protest beliefs on the other were detected. These impacts of conscientiousness were unexpected but they could also be explained by the high level of effort that conscientious respondents put into the interview. The attempt to carefully consider and evaluate the project scenario could lead conscientious respondents to be more critical on certain aspects of the project than respondents with a low level of conscientiousness. At the same time, respondents who were more cautious might feel more confident in their decision making leading them to select the extreme response options of the Likert scales. Taken together, these findings underscore the importance of conscientiousness for explaining response behavior in CVM.

In conclusion, it must be stated that personality characteristics are an important factor that determine response behavior in contingent valuation surveys. The amount of stated WTP is determined by three personality domains which are extraversion, openness to experience, and conscientiousness. While WTP statements are positively affected by openness to experience and conscientiousness, they are negatively biased by extraversion. Agreeableness appears not to be associated with WTP answers in this study. Neuroticism, despite being unrelated to stated WTP on the domain level, negatively influences many forms of response behavior and is expected to be an important WTP determinant on the facet level.

Chapter 6 Summary and conclusions

The purpose of the current study was to scrutinize the role of personality for systematic distortions of WTP answers in contingent valuation surveys. Although the existence of systematically distorted responses in CVM surveys has long been acknowledged, reasons for their occurrence have been attributed mainly to the components of the CVM survey instrument, which trigger the disturbing effects on the WTP answers. Little attention has been paid, however, to the psychological characteristics of survey respondents, which may as well play an important role. In particular, insights from modern personality psychological research which has already been applied in the recent decades in the fields of economic psychology and behavioral economics have not been given much consideration in the context of environmental valuation. Therefore, this study analyzed the impact of personality characteristics on WTP statements from both theoretical and empirical points of view. As such, it provides an important opportunity to advance the understanding of the psychological process leading to systematic biases in WTP answers.

After the introductory chapter offered rationales for a systematic analysis of personality in CVM, the theoretical foundations and procedural details of the method were presented in chapter 2. The main feature of the contingent valuation method is a survey in which the respondents are directly asked to form an idea of the value that an environmental project might generate for them and to report this individual valuation in terms of their WTP for the realization of that project. On the basis of neoclassical welfare theory, these WTP statements can be interpreted as a measure for the individual utility change resulting from the project in question. In practice, however, the theoretical significance of WTP statements is often threatened by a variety of systematic distortions. These include many types of response bias associated with the format of the WTP elicitation question (e.g. starting point bias and range bias), hypothetical bias, the stating of protest responses, embedding and part-whole bias. The process analysis of a typical CVM interview revealed that such biases and errors occur in the course of WTP formation process (during which respondents may not be able to identify their true individual valuation of the program) and WTP elicitation process (during which respondents may deliberately misreport their WTP). This chapter ended with an introduction of a line of CVM research dealing with the WTP formation and elicitation problems from a psychological perspective, the approach that fundamentally inspired the present study's basic research design. Rather than assuming that respondents are able to derive a correct estimate of their individual

valuation and truthfully report it in practical CVM surveys, this line of CVM research contests these assumptions and is able to detect systematic relations between biases contained in WTP answers and respondents' psychological characteristics. This finding underscores the importance of psychological characteristics for detecting biases contained in WTP answers.

Chapter 3, therefore, dealt with one of the most important psychological characteristics of the human being: personality. After finding that personality construct was originally aimed to account for the whole, intact psychological characteristics of individuals, the concept and approach to its measurement were discussed from trait perspective. Trait perspective focuses on the operationalization of the concept of personality using trait dispositions, all of which can be conveniently measured using self-report inventories. Following this, the question whether and to what extent trait has an impact on people's behavior in real world situations was addressed. In this respect, well-documented findings provide a rich picture of empirically observed effects of traits on people's behavior. As traits are the psychological characteristics which are central to human behavior and which can be conveniently measured by adding some questions to a standard CVM questionnaire, it was concluded that the use of the trait concept to analyze potential biases occurring in practical CVM studies seemed justified.

In search of a specific theory of trait, which can form the conceptual basis of the empirical research of this study, the Big Five personality model (BFM) was introduced in the second half of Chapter 3. The basic idea of the BFM is that all traits that exist in the personality sphere can be represented by five broad dimensions of personality, namely neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Each of these personality dimensions or domains can be further represented by six facets, which are specific and unique aspects of the domain. After elaborating on the definitions of all domains and facets, it became clear that the BFM offers a large number of powerful traits, which can be used to detect potential biases contained in WTP answers. Chapter 3 ended with the introduction of the NEO-FFI, a 60-item personality inventory that was specifically designed to assess the five personality domains when the time available for survey –and additional questions in particular– is limited. Evidence on the cross-cultural validity of the NEO-FFI indicates that the inventory functions well in non-English speaking countries and therefore can be employed in the practical CVM study conducted in northern Thailand for the empirical part of this study.

In Chapter 4, the role of five personality domains was analyzed in the context of contingent valuation surveys. In order to provide a suitable starting point for further analysis, three reasons to consider personality in CVM were discussed in the first part of this chapter. First, personality was suspected to be the source of potential biases contained in contingent

valuation survey responses, especially stated WTP for an environmental project. Second, personality was also expected to be related to people's preferences for the environmental project. Because of these two reasons, a systematic relation between personality and WTP statements in CVM interviews was anticipated. This led to the third reason to consider personality in contingent valuation surveys. The direct links between personality and stated WTP that might be detected in this study can be useful for the development of a mechanism to identify untrustworthy WTP statements in future CVM studies. The first part of chapter 4 ended with the review of empirical research on personality in contingent valuation. As shown, so far only little use has been made of insights on personality gained in the BFM to verify CVM survey results.

The discussion of the importance to consider personality in CVM gave rise to two main research questions that were addressed in the remainder of the study. The first research question concerned the applicability and validity of the BFM to explain the respondents' personality in a practical CVM survey that was conducted in Thailand. To answer this question, responses to the NEO-FFI were analyzed. In this respect, it was hypothesized that the five factor structure would emerge from the dataset indicating that CVM respondents possess the five personality domains. In order for the BFM to be useful for CVM, however, there must be a systematic relation between the Big Five and contingent valuation survey responses, especially stated WTP. Hence, the second research question focused on the association between the five personality dimensions on the one hand and stated WTP and CVM response behavior on the other. To answer this second research question, the theoretical links between personality and WTP answers were analyzed in detail. The amount of stated WTP was anticipated to be negatively and positively determined by neuroticism and extraversion respectively. A positive relation between openness to experience and agreeableness on the one hand and the amount of WTP on the other was expected. However, conscientiousness was not expected to influence WTP statements. Apart from these, the theoretical consideration predicted the relationship between the five personality domains and other forms of response behavior, namely the amount of time respondents used to complete the survey, extreme response style, and protest belief.

The derived theoretical predictions of the influence of the Big Five on stated WTP and contingent valuation survey responses were verified in a practical CVM survey conducted to estimate the social value of a tap water improvement program in northern Thailand. The study was conducted within the framework of the Collaborative Research Center (SFB) 564 "Research for Sustainable Land Use and Rural Development in Mountainous Regions of Southeast Asia." The results of that study were presented in Chapter 5. Using factor analytical

method, it was found that the personality of respondents in the survey can indeed be characterized by the five personality dimensions. It was further shown, however, that 20 question items of the NEO-FFI functioned poorly. They were consequently excluded from further analysis.

As expected, a number of systematic relationships between the personality characteristics of CVM respondents and their responses to the WTP question were found both in the DC and the PC dataset. Openness to experience and conscientiousness exhibited a significantly positive effect on WTP statements for both question formats, whereas extraversion was significantly negatively related to WTP only in the PC format. Surprisingly, neuroticism and agreeableness did not have any effect on WTP responses. When it comes to the influence of the five domains on other forms of contingent valuation survey responses, neuroticism showed a negative impact on extreme responses and a positive effect on protest belief. Extraversion showed a negative impact on response time. Conscientiousness displayed positive influence on extreme responses, response time, and protest belief. No impact of openness to experience and agreeableness on contingent valuation survey responses were found.

Taken together, these results suggest that the personality characteristics of the respondents as measured by 40-item NEO-FFI have explanatory power for WTP as well as for other contingent valuation survey responses in addition to the usual socio-economic and attitudinal characteristics of the survey respondents. So, the personality characteristics of respondents play an important role in the CVM study conducted for this study. Each of the five domains, however, plays a rather different role. Neuroticism appears to be an important determinant of protest belief and middle response style. Extraversion contributes to the understating of respondents' WTP and the low effort respondents put into answering survey questions. Openness to experience and conscientiousness are systematically related to individual preferences for the proposed tap water improvement program. At the same time, conscientiousness leads respondents to be thorough in the survey and is a source of protest belief and extreme responses.

These findings confirm that the integration of the personality concept into the theoretical framework of the CVM offers new insights into the psychological processes leading to systematic variations in WTP answers and other forms of contingent valuation survey responses. Such new insights give rise to a number of recommendations for further CVM surveys to be discussed in the following. The first recommendation is that future contingent valuation surveys should make a greater effort to assess individual differences in the domains of openness to experience and conscientiousness of the respondents in order to verify their WTP

statements. This recommendation stems from the finding that openness to experience and conscientiousness displayed a significantly positive effect on stated WTP in both the DC and PC versions of the survey. An explanation of the observed significant relationships is that respondents with a high level of these personality traits have a higher preference and, therewith, higher WTP for the project scenario than low scorers. Consequently, those WTP responses that do not conform to this expectation should be identified and discarded.

The second recommendation follows from the result that extraversion exhibited a significantly negative effect on stated WTP in the PC dataset. An explanation of this result is that extraversion is associated with the understating of respondents' WTP. Due to this reason, future contingent valuation surveys using PC elicitation method should take this fact into account and assess the extraversion domain of the respondents so that the deliberate understatements of their WTP can be detected. Based on the data of this study, the negative impact of extraversion was not found in the survey using the DC elicitation question format. The small sample size may account for this absence of effect. This hypothesis still needs to be tested in future studies.

Third, the findings that neuroticism positively affects protest belief and negatively impacts extreme response style gave rise to the conclusion that neuroticism was an important source of bias in many forms of survey responses. It is therefore recommended that the neuroticism domain should be assessed in future applications of the CVM in order to take its biasing effects into account.

The fourth recommendation stems from the evidence of the NEO-FFI's validity. It was found in this study that the NEO-FFI did not perform very well in the suburban context of Mae Rim, northern Thailand. One possible reason is that respondents become tired of the survey task after completing the main CVM questionnaire. A 60-item inventory such as the NEO-FFI might be too large for the respondent. Based on the present data, the use of the NEO-FFI in CVM interviews cannot be recommended. However, since the sample size of this study is rather small (N=570), further evidence for the performance of the NEO-FFI in a larger sample is therefore necessary. Other personality inventories such as the BFI-10 that relies only on 10 short phrases to assess the Big Five (Rammstedt and John 2007) should also be tested for their applicability in the CVM survey.

Although the present study has successfully detected various response patterns that are driven by the underlying personality of CVM respondents, it also has certain limitations that call for further investigation. First of all, it remains unclear whether the broad personality dimension or domain is the most appropriate level of specificity for describing the personality

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of CVM respondents in order to predict their WTP responses. Facets, due to their specific and narrow meanings, may be able to offer a more fine-grained understanding of the psychological processes leading to the statement of WTP than broad domains. Yet, since the respondents' tasks of forming and stating a WTP for an environmental good are both complex and interrelated, global personality traits might have higher predictive power than specific traits. In modern personality psychological research, this issue is known as the bandwidth-fidelity dilemma in personality assessment (Ones and Viswesvaran 1996) and has been subject to considerable debate. While conventional wisdom has it that specific and narrow measures of traits produce more detailed insights into people's behavior and so should always be preferred over broad and general measures of traits, many authors have found counterevidence and demonstrated that broad personality measures are better in predicting and explaining behavior in certain areas of interest, such as job performance (Ones and Viswesvaran 1996). An alternative point of view is that the appropriate level of abstractness of personality traits depends on the topic under investigation (Hogan and Roberts 1996). Based on the data of this study, it is conceivable that the suitable level of specification depends on both the topic being investigated and the personality domains under consideration. It was found in this study that, to explain stated WTP, it is more appropriate to use the domain of openness to experience. Yet for other forms of contingent valuation responses, the predictive power of openness to experience seemed to disappear. For neuroticism, the opposite is the case. Since the data in this study were not suited to give a conclusive answer to this issue, future research on this topic should investigate this tentative hypothesis.

Another important limitation of this study that needs to be discussed stems from the fact that the exact form of interaction among facets of a particular domain is unknown. The BFM as conceptualized by Costa and McCrae leaves open the mechanism through which facets function together as an intact, coherent entity (domain) to impact people's behavior (Costa and McCrae 1992b, p. 16). To keep the analysis simple, it was assumed in this study that all facets function with the same intensity. It is, however, conceivable that different facets function with different intensities, and these intensities might in turn be contingent on the given situational context. Facets of neuroticism, for instance, might function differently in different contexts. While self-consciousness might function with higher intensity than anxiety and thus dominate its effect in the context of in-person CVM interviews, the opposite might be true when it comes to answering contingent valuation questions in a mail interview. Since the exact form of these interlinks among facets can have a decisive effect on the predicted links between the Big Five and stated WTP, this issue should be investigated further.

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One source of weakness in this study which could have affected its outcome was the fact that the NEO-FFI is only the condensed version of the original inventory designed to measure the Big Five: the NEO-PI-R. The NEO-PI-R consists of 240 items, every eight of which assess one facet. To compute domain scores, the scores of facets constituting a domain are summed. From this it is clear that the obtained domain scores as assessed by the NEO-PI-R contain complete information on their facets. This is not the case for the NEO-FFI. The 60 question items contained in the NEO-FFI were selected from the original 240 by means of factor analysis. These 60 items had the highest factor loadings on the corresponding domains and thus contribute most to their meaning. The problem is that domain scores as measured by the NEO-FFI would contain only partial information on their facets. Therefore, some level of error could have resulted from the use of these scales to test predictions that were formulated based on all facets. Further study is needed to establish this.

In conclusion, this study develops a new approach to investigate systematic variations in WTP answers in a contingent valuation survey. This approach, which is based on a conceptual framework of modern personality psychology, allows for a broader perspective on response behavior in contingent valuation interviews. In addition to their true individual valuation of an environmental project, respondents are viewed as being influenced by their underlying personality characteristics for selecting their WTP responses in contingent valuation surveys. By means of a personality model, these personality characteristics can be identified and their influence on WTP response behavior can be predicted. The fact that systematic relationships between the personality characteristics of respondents and their stated WTP can be detected in this particular CVM study underscores the explanatory power of this new perspective. The results of this study, therefore, stress the necessity to adopt a broader perspective on response behavior in CVM interviews. When it comes to direct valuation methods like contingent valuation and discrete choice experiments, the characteristics of the survey design and of the survey participants as well as their interactions are an important source of systematically distorted responses and as a consequence these factors should be explicitly taken into account in the empirical analysis. With this broader perspective on CVM, new insights into the processes leading to potential biases in WTP answers can be gained and recommendations for the improvement of the validity of WTP estimates can be derived. This study should be seen as a first step towards such a perspective.

References

Aadland, D. and A. J. Caplan (2006). Cheap talk reconsidered: New evidence from CVM. *Journal of Economic Behavior & Organization* 60: 562-578.

Abdalla, C. W., B. A. Roach and D. J. Epp (1992). Valuing environmental quality changes using averting expenditures: an application to groundwater. *Land Economics* 68(2): 163-169.

Abrahams, N. A., B. J. Hubbell and J. L. Jordan (2000). Joint production and averting expenditure measures of willingness to pay: do water expenditure really measure avoidance cost? *American Journal of Agricultural Economics* 82(2): 427-437.

Ahadi, S. and E. Diener (1989). Multiple determinants and effect size. *Journal of personality and social psychology* 56(3): 398-406.

Ahlheim, M. (1998). Measures of economic welfare. Handbook of utility theory. S. Barbera, P. J. Hammond and C. Seidl. Norwell, MA, Kluwer Academic Publishers: 484-568.

Ahlheim, M. (2002). Project appraisal and the reclamation of disturbed landscapes. *Hohenheimer Diskussionsbeiträge 202/2002*.

Ahlheim, M., B. Ekasingh, O. Frör, J. Kitchaicharoen, A. Neef, C. Sangkapitux and N. Sinphurmsukskul (2010). Better than their reputation: enhancing the validity of contingent valuation mail survey results through citizen expert groups. *Journal of Environmental Planning and Management* 53(2): 163-182.

Ahlheim, M. and O. Frör (2003). Valuing the non-market production of agriculture. *Agrarwirtschaft* 52(8): 356-369.

Ahmed, M., G. M. Umali, C. K. Chong, M. F. Rull and M. C. Garcia (2007). Valuing recreational and conservation benefits of coral reefs:the case of Bolinao, Philippines. *Ocean & Coastal Management* 50(1-2): 103-118.

Ajzen, I. (2005). Attitudes, personality, and behavior. Berkshire, Open University Press.

Albanese, P. J. (1987). The nature of preferences: An exploration of the relationship between economics and psychology. *Journal of Economic Psychology* 8(1): 3-18.

Allport, G. W. (1937). Personality: A Psychological Interpretation New York, Holt.

Allport, G. W. (1961). Pattern and growth in personality. New York, Holt, Rinehart & Winston.

Allport, G. W. and H. S. Odbert (1936). Trait-names: A psycholexical study. New York, Princeton.

Almlund, M., A. L. Duckworth, J. Heckman and T. Kautz (2011). Personality psychology and economics. Handbook of the economics of education. E. A. Hanushek, S. Machin and L. Woessmann. Amsterdam, North-Holland. 4: 1-182.

Aluja, A., O. García, J. Rossier and L. García (2005). Comparison of the NEO-FFI, the NEO-FFI-R and an alternative short version of the NEO-PI-R (NEO-60) in Swiss and Spanish samples. *Personality and Individual Differences* 38: 591–604.

Álvarez-Farizo, B., N. Hanley, R. Barberán and A. Lázaro (2007). Choice modeling at the "market stall": Individual versus collective interest in environmental valuation. *Ecological Economics* 60: 743-751.

American Psychological Association (1954). Technical recommendations for psychological tests and diagnostic techniques. *Psychological Bulletin* 51(2): 1-38.

Andreoni, J. (1989). Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence. *Journal of Political Economy* 97(6): 1447-1458.

Andreoni, J. (1990). Impure altruism and donations to public goods: a theory of warm-glow giving. *Economic Journal* 100(401): 464-477.

Arrow, K. and A. C. Fisher (1974). Environmental preservation, uncertainty, and irreversibility. *The quarterly journal of economics* 88: 312-319.

Arrow, K., R. Solow, P. R. Portney, E. E. Leamer, R. Radner and H. Schuman (1993). Report of the NOAA panel on contingent valuation: natural resource damage assessment under the oil pollution act of 1990. *Federal Register* 58: 4601-4614.

Arrow, K. J. (1963). Social choice and individual values. New York, John Wiley and Sons.

Ashton, M. C., K. Lee and P. S. V. (2002). What is the central feature of extraversion? Social attention versus reward sensitivity. *Journal of Personality and Social Psychology* 83(1): 245-252.

Attfield, R. (1998). Existence value and intrinsic value. *Ecological Economics* 24: 163-168.

Bassili, J. N. and J. Fletcher (1991). Response-time measurement in survey research: A method for CATI and a new look at non-attitudes *Public opinion quarterly* 60: 390-399.

Bateman, I. J., R. T. Carson, B. Day, M. Hanemann, N. Hanley, T. Hett, M. Jones-Lee, G. Loomes, S. Mourato, E. Ozdemiroglu, D. W. Pearce, R. Sugden and J. Swanson (2002). Economic valuation with stated preference techniques. Cheltenham, Edward Elgar.

Bateman, I. J., B. Day, S. Georgiou and I. Lake (2006). The aggregation of environmetnal benefit values: Welfare measures, distance decay and total WTP. *Ecological Economics* 60: 450-460.

Bateman, I. J., I. H. Langford, R. K. Turner, K. G. Willis and G. D. Garrod (1995). Elicitation and truncation effects in contingent valuation studies. *Ecological Economics* 12: 161-179.

Bateman, I. J. and J. Mawby (2004). First impressions count: interviewer appearance and information effects in stated preference studies. *Ecological Economics* 49: 47-55.

Baumgartner, H. and J.-B. E. M. Steenkamp (2001). Response styles in marketing research: A cross-national investigation. *Journal of Marketing Research* 38(2): 143-156.

Becker, A., T. Deckers, T. J. Dohmen, A. Falk and F. Kosse (2012). The relationship between economic preferences and psychological personality measures. *Discussion Paper No. 6470, Institute for the Study of Labor (IZA), Germany*.

Berry, D. A. and B. W. Lindgren (1996). Statistics: theory and methods. Belmont, Wadsworth Publishing Company.

Bhat, M. G. (2003). Application of non-market valuation to the Florida Keys marine reserve management. *Journal of Environmental Management* 67(4): 315-325.

Bishop, R. C. and T. A. Heberlein (1979). Measuring values of extra-market goods: are indirect measures biased? *American Journal of Agricultural Economics* 61: 936-940.

Block, J. (1977). Advancing the psychology of personality: Paradigmatic shift or improving the quality of research? . Personality at the cross-roads: Current issues in interactional psychology D. Magnusson and N. S. Endler. Hillsdale, NJ, Erlbaum: 37-64.

Block, J. (1995). A contrarian view of the Five-Factor approach to personality description. *Psychological Bulletin* 117(2): 187-215.

Blumenschein, K., G. Blomquist, M. Johannesson, N. Horn and P. Freeman (2008). Eliciting willingness to pay without bias: Evidence from a field experiment. *Economic Journal* 118(1): 114-137.

Bockstael, N. E. and C. L. Kling (1988). Valuing environmental quality: Weak complementarity with sets of goods. *American Journal of Agricultural Economics* 70(3): 654-662.

Börger, T. (2013). Keeping up appearances: Motivations for socially desirable responding in contingent valuation interviews *Ecological Economics* 87: 155-165.

Buss, A. H. and R. Plomin (1975). A temperament theory of personality development. New York, Wiley.

Carducci, B. J. (2009). The psychology of personality: Viewpoints, research, and applications. West Sussex, John Wiley & Sons.

Carson, R. T., N. E. Flores, K. M. Martin and J. L. Wright (1996). Contingent valaution and revealed preference methodologies: comparing the estimates for quasi-public goods. *Land Economics* 72(1): 80-99.

Carson, R. T. and W. M. Hanemann (2005). Contingent valuation. Handbook of environmental economics. K.-G. Mäler and J. R. Vincent. Amsterdam, Elsevier. 2**:** 821-936.

Cattell, R. B. (1943). The description of personality II: basic traits resolved into clusters. *Journal of Abnormal and Social psychology* 38: 476-507.

Cattell, R. B. (1947). Confirmation and clarification of the plimary personality factors. *Psychometrika* 12: 197-220.

Champ, P. A. and R. C. Bishop (2001). Donation payment mechanisms and contingent valuation: an empirical study of hypothetical bias. *Environmental and Resource Economics* 19: 383-402.

Champ, P. A., R. C. Bishop, T. C. Brown and D. W. McCollum (1997). Using donation mechanisms to value nonuse benefits from public goods. *Journal of Environmental Economics and Management* 33: 151-162.

Chang, L., K. T. Hau and A. M. Guo (2001). The effect of self-consciousness on the expression of gender views. *Journal of Applied Social Psychology* 31(2): 340-351.

Chen, W., H. Hong, Y. Liu, L. Zhang, X. Hou and M. Raymond (2004). Recreation demand and economic value: an application of travel cost method for Xiamen Island. *China Economic Review* 15(4): 398-406.

Cheung, F. M., F. J. R. van de Vijver and F. T. L. Leong (2011). Toward a new approach to the study of personality in culture *American Psychologist* 66(7): 593-603.

Chilton, S. M. and W. G. Hutchinson (2003). A qualitative examination of how respondents in a contingent valuation study rationalise their WTP responses to an increase in the quantity of the environmental good. *Journal of Economic Psychology* 24: 65-75.

Churchill, G. A. and J. D. Lacobucci (2002). Marketing Research: Methodological foundation. Ohio, Thomson Learning.

Clark, J., J. Burgess and C. M. Harrison (2000). I struggled with this money business: respondents' perspectives on contingent valuation. *Ecological Economics* 33(1): 45-62.

Clawson, M. and J. L. Knetsch (1966). Economics of outdoor recreation Baltimore, Johns Hopkins University Press.

Connolly, J. J., E. J. Kavanagh and C. Viswesvaran (2007). The convergent validity between self and observer ratings of personality: a meta-analytic review. *International Journal of Selection and Assessment* 15(1): 110-117.

Costa, P. T. and R. R. McCrae (1988). Personality in adulthood: a six-year longitudinal study of self-reports and spouse ratings on the NEO personality inventory. *Journal of personality and social psychology* 54(5): 853-863.

Costa, P. T. and R. R. McCrae (1992a). Four ways five factors are basic. *Personality and Individual Differences* 13(6): 653-665.

Costa, P. T. and R. R. McCrae (1992b). Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEOFFI) professional manual. Odessa, FL, Psychological Assessment Resources, Inc.

Costa, P. T. and R. R. McCrae (1997). Longitudinal stability of adult personality. Handbook of personality psychology. R. Hogan, J. Johnson and S. Briggs. London, Academic Press**:** 269-290.

Costa, P. T., R. R. McCrae and D. A. Dye (1991). Facet scales for Agreeableness and Conscientiousness: A revision of the NEO Personality Inventory. *Personality and Individual Differences* 12: 887-898.

Costello, A. B. and J. W. Osborne (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical assessment,*

research and evaluation 10(7): Available online: http://pareonline.net/getvn.asp?v=10&n=17.

Cronbach, L. J. and P. E. Meehl (1955). Construct validity in psychological tests. *Psychological Bulletin* 52(4): 281-302.

Cummings, R. G. and L. O. Taylor (1999). Unbiased value estimates for environmental goods: a cheap talk design for the contingent valuation method *The American Economic Review* 89(3): 649-665.

Davis, J. (2004). Assessing community preferences for development projects: are willingness to pay studies robust to mode effects? *World Development* 32(4): 655-672.

De Raad, B. (2000). The big five personality factors: the psycholexical approach to personality. Seattle, Hogrefe and Huber Publishers.

Desvousges, W., K. Mathews and K. Train (2012). Adequate responsiveness to scope in contingent valuation. *Ecological Economics* 84: 121-128.

Desvousges, W. H., A. R. Gable, R. W. Dunford and S. P. Houdson (1993). Contingent valuation: The wrong tool to measure passive-use losses. *Choices* 2: 9-11.

Desvousges, W. H., F. R. Johnson, R. W. Dunford, S. P. Hudson, K. N. Wilson and K. J. Boyle (1992). Measring nonuse damages using contingent valuation: An experimental evaluation of accuracy. *Research Triangle Institute Monograph*.

DeYoung, C. G., J. B. Peterson and D. M. Higgins (2005). Sources of openness/intellect: cognitive and neuropsychological correlates of the fifth factor of personality. *Journal of Personality* 73(4): 825-858.

Diamond, P. A. and J. A. Hausman (1993). On contingent valuation measurement of nonuse values. Contingent valuation: a critical assessment. J. A. Hausman. Amsterdam, North-Holland.

Diamond, P. A. and J. A. Hausman (1994). Contingent valuation: is some number better than no number? *Journal of Economic Perspectives* 8(4): 45-64.

Digman, J. M. and N. K. Takemoto-Chock (1981). Factors in the natural language of personality: re-analysis, comparison, and interpretation of six major studies. *Multivariate Behavioral Research* 16: 149-170.

DiStefano, C., M. Zhu and D. Mindrilă (2009). Understanding and using factor scores: Considerations for the applied researcher. *Practical assessment, research and evaluation* 14(20): Available online: http://pareonline.net/getvn.asp?v=14&n=20.

Doherty, K. and B. R. Schlenker (1991). Self-consciousness and strategic self-presentation. *Journal of Personality* 59(1): 1-18.

Entwistle, D. R. (1972). To dispel fantasies about fantasy-based measures of achievement motivation. *Psychological Bulletin* 77: 377-391.

Epstein, S. (1979). The stability of behavior: On predicting most of the people much of the time. *Journal of personality and social psychology* 37: 1097-1126.

Epstein, S. (1983). Aggregation and beyond: Some basic issues on the prediction of behavior. *Journal of Personality* 51(3): 360 - 392.

Epstein, S. and E. J. O'Brien (1985). The person-situation debate in historical and current perspective. *Psychological Bulletin* 98(3): 513-537.

Ethier, R. G., G. L. Poe, W. D. Schulze and J. Clark (2000). A comparison of hypothetical phone and mail contingent valuation responses for green-pricing electricity programs. *Land Economics* 76(1): 54-67.

Eysenck, H. J. (1947). Dimensions of personality. London, Routledge & Kegan Paul.

Eysenck, H. J. (1967). The biological basis of personality. Springfield, Thomas.

Eysenck, H. J. (1990). Genetic and environmental contributions to individual differences: the three major dimensions of personality *Journal of Personality* 58(1): 245-261.

Eysenck, H. J. (1992). Four ways five factors are not basic. *Personality and Individual Differences* 13(6): 667-673.

Eysenck, H. J. and M. W. Eysenck (1985). Personality and individual differences: A natural science approach. New York, Plenum.

Fabrigar, L. R., D. T. Wegener, R. C. MacCallum and E. J. Strahan (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological methods* 4(3): 272-299.

Ferreira, S. and L. Gallagher (2010). Protest responses and community attitudes toward accepting compensation to host waste disposal infrastructure. *Land Use Policy* 27: 638-652.

Fischer, A. and N. Hanley (2007). Analysing decision behaviour in stated preference surveys: A consumer psychological approach. *Ecological Economics* 61: 303-314.

Fiske, D. W. (1949). Consistency of the factorial structures of personality ratings from different sources. *Journal of Abnormal and Social psychology* 44: 329-344.

Fix, P. and J. Loomis (1998). Comparing the economic value of mountain biking estimated using revealed and stated preference. *Journal of Environmental Planning and Management* 41(2): 227-236.

Fletcher, J. F. and M. C. Chalmers (1991). Attitudes of Canadians toward affirmative action: Opposition, value pluralism and nonattitudes. *Political behavior* 12: 67-96.

Freud, S. (1913). The Interpretation of dreams. New York, Bartleby.com, 2010

Frör, O. (2008). Bounded rationality in contingent valuation: empirical evidence using cognitive psychology. *Ecological Economics* 68: 570-581.

Funder, D. C. (2009). Persons, behaviors and situations: An agenda for personality psychology in the postwar era. *Journal of Research in Personality* 43: 120-126.

Goldberg, L. R. (1981). Language and individual differences: the search for universals in personality lexicons. Review of personality and social psychology. L. Wheeler. Beverly Hills, Sage. 2**:** 141-165.

Goldberg, L. R. (1990). An alternative description of personality: the Big-Five factor structure. *Journal of personality and social psychology* 59: 1216-1229.

Goldberg, L. R. (1993). The structure of phenotypic personality traits. *American Psychologist* 48(1): 26-34.

Gow, A. J., M. C. Whiteman, A. Pattie and I. J. Deary (2005). Goldberg's IPIP Big-Five factor markers: Internal consistency and concurrent validation in Scotland. *Personality and Individual Differences* 39: 317–329.

Gray, J. A. (1982). The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system. New York, Oxford University Press.

Grebitus, C., J. L. Lusk and R. M. N. Jr. (2013). Explaining differences in real and hypothetical experimental auctions and choice experiments with personality. *Journal of Economic Psychology* 36: 11-26.

Greene, W. H. (2007). Limdep version 9.0 reference guide, Plainview.

Groves, R. M., J. Floyd J. Fowler, M. P. Couper, J. M. Lepkowski, E. Singer and R. Tourangeau (2004). Survey methodology. New Jersey, Wiley & Sons.

Hall, J., R. Viney, M. Haas and J. Louviere (2004). Using stated preference discrete choice modeling to evaluate health care programs. *Journal of Business Research* 57: 1026-1032.

Hanemann, W. M. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics* 66(3): 332-341.

Hanemann, W. M. (1985). Some issues in continuous- and discrete-response contingent valuation studies. *Northeastern journal of agricultural and resource economics* 14(1): 5-13.

Hanley, N. (2001). Cost-benefit analysis and environmental policymaking *Environment and Planning C: Government and Policy* 19: 103-118.

Hanley, N. and E. B. Barbier (2009). Pricing Nature - Cost-benefit analysis and environmental policy. Cheltenham, Edward Elgar.

Hanley, N., F. Schläpfer and J. Spurgeon (2003). Aggregating the benefits of environmental improvements: distance-decay functions for use and non-use values. *Journal of Environmental Economics and Management* 68: 297-304.

Hanley, N., J. F. Shogren and B. White (2001a). Introduction to environmental economics. New York, Oxford University Press.

Hanley, N., J. F. Shogren and B. White (2001b). Valuing the environment and natural resources. Oxford, Oxford University Press.

Hanley, N. and C. L. Spash (1993). Cost-benefit analysis and the environment. Cheltenham, Edward Elgar.

Harzing, A.-W. (2006). Resposne styles in cross-national survey research: A 26-country study. *Cross cultural management* 6(2): 243-266.

Heidhues, F. (2007). Conclusions and outlook to the edited volume. Sustainable land use in mountainous regions of Southeast Asia. F. Heidhues, L. Herrmann, A. Neef, S. Neidhart, J. Pape and V. Zárate. Heidelberg, Springer-Verlag**:** 399-409.

Heidhues, F. and J. Pape (2007). Sustainable land use and sustainable rural livelihoods in mountainous regions of Southeast Asia -Meeting the challenges of ecological, socio-economic and cultural diversity. Sustainable land use in mountainous regions of Southeast Asia. F. Heidhues, L. Herrmann, A. Neef, S. Neidhart, J. Pape and V. Zárate. Heidelberg, Springer-Verlag**:** 1-14.

Herriges, J. A. (1999). Measuring goodness of fit for the double-bounded logit model: Comment. *American journal of agricultural economics* 81(1): 231-234.

Hicks, J. (1942). Consumer's surplus and index numbers. *Review of Economic Studies* 9: 126-137.

Hicks, J. R. (1939). The foundations of welfare economics. *Economic Journal* 49: 696-712.

Hofstee, W. K. B. (1994). Who should own the definition of personality? *European Journal of Personality* 8: 149-162.

Hogan, J. and B. W. Roberts (1996). Issues and non-issues in the fidelity-bandwidth trade-off. *Journal of organizational behavior* 17: 627-637.

Hogan, R. (2007). Personality and the fate of organizations. New Jersey, Lawrence Erlbaum Associates

Hogan, R. (2009). Much ado about nothing: The person-situation debate. *Journal of Research in Personality* 43: 249.

Howard, J. (1994). Buyer behaviour in marketing strategy. Englewood Cliffs, Prentice Hall.

Hull, D. M., A. A. Beaujean, F. C. Worrell and A. E. Verdisco (2010). An item-level examination of the factorial validity of NEO Five-Factor Inventory scores. *Educational and psychological measurement* 70(6): 1021-1041.

Jacoby, J. (1971). Personality and innovation proneness. *Journal of Marketing Research* 8: 244-247.

John, O. P., A. Angleitner and F. Ostendorf (1988). The lexical approach to personality: A historical review of trait taxonomic research. *European Journal of Personality* 2: 171-203.

John, O. P., L. P. Naumann and C. J. Soto (2008). Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues. Handbook of personality: Theory and research. O. P. John, R. W. Robins and L. A. Pervin. New York, The Guilford Press**:** 114-158.

John, O. P. and S. Srivastava (1999). The Big-Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives. Handbook of personality: Theory and research. L. Pervin and O. P. John. New York, Guilford: 727.

John, O. P. and S. Srivastava (2001). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives. Handbook of personality: Theory and research. L. Pervin and O. P. John. New York, Guilford: 102-138.

Johnson, J. A. (1997). Units of analysis for the description and explanation of personality Handbook of personality psychology. R. Hogan, J. Johnson and S. Briggs. London, Academic Press: 73-91.

Johnston, R. J. (2006). Is hypothetical bias universal? Validating contingent valuation responses using a binding public referendum. *Journal of Environmental Economics and Management* 52(1): 469-481.

Jorgensen, B. S., M. A. Wilson and T. A. Heberlein (2001). Fairness in the contingent valuation of environmental public goods: attitude toward paying for environmental improvements at two levels of scope. *Ecological Economics* 36: 133-148.

Jung, C. G. (1913/1971). Psychological types: Collected works NJ, Princeton University Press.

Kagen, J. (1988). The meanings of personality predicates. *American Psychologist* 43: 614-620.

Kagen, J. (2005). A time for specificity. *Journal of Personality Assessment* 85(2): 125-127.

Kagen, J. (2007). A trio of concerns. *Perspectives on Psychological Science* 2: 361-376.

Kahneman, D. and J. L. Knetsch (1992). Valuing public goods: the purchase of moral satisfaction. *Journal of Environmental Economics and Management* 22: 57-70.

Kahneman, D., I. Ritov, K. E. Jacowitz and P. Grant (1993). Stated willingness to pay for public goods: a psychological perspective. *Psychological science* 4: 310-315.

Kahneman, D., I. Ritov and D. Schkade (1999). Economic preferences or attitude expressions?: an analysis of dollar responses to public issues. *Journal of risk and uncertainty* 19: 203-235.

Kaldor, N. (1939). Welfare propositions of economics and interpersonal comparisons of utility *Economic Journal* 49: 549-552.

Kaosa-ard, M. (2001). Ecosystem management in northern Thailand. Institutions, livelihoods and the environment: Change and response in mainland southeast asia. A. Straub. Copenhagen, NIAS Publishing: 129-165.

Kassarjian, H. H. (1971). Personality and Consumer Behavior: A Review. *Journal of Marketing Research* 8: 409-418.

Kassarjian, H. H. and M. J. Sheffet (1981). Personality and consumer behavior: An update. Perspectives in consumer behavior. H. H. Kassarjian and T. Robertson. Glenview, IL Scott, Foresman and Co.: 160-180.

Kassarjian, H. H. and M. J. Sheffet (1991). Personality and consumer behavior: An update. Perspectives in consumer behavior. H. H. Kassarjian and T. Robertson. Englewood Cliffs, NJ, Prentice-Hall: 281-303.

Kenyon, W. and C. Nevin (2001). The use of economic and participatory approaches to assess forest development: a case study in the Ettrick Valley. *Forest Policy and Economics* 3: 69-80.

Kline, P. (2008). An easy guide to factor analysis. East Sussex, Routledge.

Krutilla, J. V. (1967). Conservation reconsidered. *The American Economic Review* 57(4): 777-786.

Lancaster, K. J. (1966). A new approach to consumer theory. *Journal of Political Economy* 74(2): 132-157.

Leininger, A. (2002). Vietnamese American personality and acculturation: an exploration between personality traits and cultural goals. The five-factor model of personality across cultures. R. R. McCrae and J. Allik. New York, Kluwer Academic Publisher: 197-227.

Lienhoop, N. and D. MacMillan (2007). Valuing wilderness in Iceland: estimation of wta and wtp using the market stall appraoch to contingent valuation. *Land Use Policy* 24: 289-295.

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology* 22(140): 55.

List, J. (2001). Do explicit warnings eliminate the hypothetical bias in elicitation procedure? evidence from filed auctions for sportcards. *The American Economic Review* 91(5): 1499-1507.

List, J. A., P. Sinha and M. H. Taylor (2006). Using Choice Experiments to Value Non-Market Goods and Services: Evidence from Field Experiments. *Advances in Economic Analysis & Policy* 6(2): 1-37.

Liston-Heyes, C. and A. Heyes (1999). Recreational benefits from the Dartmoor national park. *Journal of Environmental Management* 55(2): 69-80.

Lodhi, P. H., S. Deo and V. M. Belhekar (2002). The five-factor model of personality in Indian context: measurement and correlates. The five-factor model of personality across cultures. R. R. McCrae and J. Allik. New York, Kluwer Academic Publisher: 227-248.

Loevinger, J. (1957). Objective tests as instruments of psychological theory. *Psychological Reports* 3: 635-694.

Loewenstein, G. (2000). Emotions in economic theory and economic behavior. *The American Economic Review* 90(2): 426-432.

Loewenstein, G. and J. S. Lerner (2003). The role of affect in decision making. Handbook of affective science. R. J. Davidson, K. R. Sherer and H. H. Goldsmith. Oxford, Oxford University Press.

Loomis, J. and M. King (1994). Comparison of mail and telephone-mail contingent valuation surveys. *Journal of Environmental economics Management* 41: 309-324.

Lorr, M. and R. P. Youniss (1973). An inventory of interpersonal style. *Journal of Personality Assessment* 37(2): 165-173.

Lucas, R. E., E. Diener, A. Grob, E. M. Suh and L. Shao (2000). Cross-cultural evidence for the fundamental features of extraversion. *Journal of personality and social psychology* 79(3): 452-468.

Luft, J. (1969). Of human interaction. Palo Alto, Califonia, National Press Books.

Lusk, J. L., T. Nilsson and K. Foster (2007). Public preference and private choices: Effect of altruism and free riding on demand for environmentally certified pork. *Environmental and Resource Economics* 36: 499-521.

Macmillan, D. C., L. Philip, N. Hanley and B. Álvarez- Farizo (2002). Valuing the non-market benefits of wild goose conservation: a comparison of interview and group-based approaches. *Ecological Economics* 43: 49-59.

Mäler, K.-G. (1974). Environmental economics: A theoretical inquiry. Baltimore, Resources for the Future.

Matthews, G., I. J. Deary and M. C. Whiteman (2009). Personality traits. New York, Cambridge University Press.

Matthews, G. and K. Gilliland (1999). The personality theories of H. J. Eysenck and J. A. Gray: a comparative review. *Personality and Individual Differences* 26: 583-626.

Mayer, J. D. (1986). How mood influences cognition. Advances in cognitive science. N. E. Sharkey. West Sussex, Ellis Horwood Limited.

Mayer, J. D., Y. N. Gaschke, D. L. Braverman and T. W. Evans (1992). Mood-congruent judgment is a general effect. *Journal of personality and social psychology* 63(1): 119-132.

McAdams, D. P. (1992). The Five -Factor model in personality: A critical appraisal. *Journal of Personality* 60(2): 329-361.

McAdams, D. P. (1997). A conceptual history of personality psychology. Handbook of personality psychology. R. Hogan, J. Johnson and S. Briggs. London, Academic Press**:** 4-40.

McAdams, D. P. (2001). The person: an integrated introduction to personality psychology. Florida, Harcourt College publishers.

McCrae, R. R. (1982). Consensual validation of personality traits: evidence from self-reports and ratings. *Journal of personality and social psychology* 43: 293-303.

McCrae, R. R. (1994). Openness to Experience: expanding the boundaries of factor V. *European Journal of Personality* 8(4): 251 - 272.

McCrae, R. R. and P. T. Costa (1983). Social desirability scales: More substance than style. *Journal of Consulting and Clinical Psychology* 51(6): 882-888.

McCrae, R. R. and P. T. Costa (1985). Updating Norman's "adequate taxonomy": Intelligence and personality dimensions in natural language and in questionnaires. *Journal of personality and social psychology* 49: 710-721.

McCrae, R. R. and P. T. Costa (1987). Validation of the Five-Factor Model of personality across instruments and observers. *Journal of Personality and Social Psychology* 52(1): 81-90.

McCrae, R. R. and P. T. Costa (1994). The stability of personality: Observation and evaluations. *Current Directions in Psychological Science* 3: 173-175.

McCrae, R. R. and P. T. Costa (1995). Trait explanations in personality psychology. *European Journal of Personality* 9: 231-252.

McCrae, R. R. and P. T. Costa (2006). Personality in adulthood. New York, The Guilford Press.

McCrae, R. R., P. T. Costa, G. H. Pilar, J. P. Rolland and W. D. Parker (1998). Cross-cultural assessment of the five-factor model: the revised NEO personality Inventory. *Journal of Cross-Cultural Psychology* 29: 171-188.

McCrae, R. R. and O. P. John (1992). An introduction to the five-factor model and its applications. *Journal of Personality* 60: 175-215.

McCrae, R. R., J. Paul T. Costa, T. A. Martin, V. E. Oryol, A. A. Rukavishnikov, I. G. Senin, M. Hrebickova and T. Urbanek (2004). Consensual validation of personality traits across cultures. *Journal of Research in Personality* 38: 179-201.

McCrae, R. R. and A. Terracciano (2005). Universal features of personality traits from the observer's perspective: data from 50 cultures. *Journal of personality and social psychology* 88(3): 547-561.

McDougall, W. (1932). Of the words character and personality. *Journal of Personality* 1(1): 3-16.

McFadden, D. (1974). Conditional logit analysis of qualitative choice behavior. Frontiers in Econometrics. New York, Academic Press**:** 105-142.

Meisenberg, G. and A. Williams (2008). Are acquiescent and extreme response styles related to low intelligence and education? *Personality and Individual Differences* 44: 1539-1550.

Menges, R., C. Schroeder and S. Traub (2005). Altruism, warm glow, and the willingness-to-donate for green electricity: An artefactual field experiment. *Environmental and Resource Economics* 31: 431-458.

Meyerhoff, J. and U. Liebe (2006). Protest beliefs in contingent valuation: Explaining their motivation *Ecological Economics* 57(4): 583-594.

Mischel, W. (1968). Personality and assessment. New York, Wiley

Mischel, W. (1973). Toward a cognitive social learning reconceptualization of personality *Psychological review* 80: 252-283.

Mitchell, R. C. and R. T. Carson (1989). Using surveys to value public goods: the contingent valuation method. Washington D. C., Resource for the Future

Morrison, M. and T. C. Brown (2009). Testing the effectiveness of certainty scales, cheap talk, and dissonance-minimization in reducing hypothetical bias in contingent valuation studies. *Environmental and Resource Economics* 44: 307-326.

Murray, G., F. Judd, H. Jackson, C. Fraser, A. Komiti, P. Pattison, A. Wearing and G. Robins (2008). Big boys don't cry: an investigation of stoicism and its mental health outcomes. *Personality and Individual Differences* 44: 1369–1381.

Naemi, B. D., D. J. Beal and S. C. Payne (2009). Personality predictors of extreme response style. *Journal of Personality* 77(1): 261-286.

Naess, A. (1986). Intrinsic value: Will the defenders of nature please rise? Conservation biology: The science of scarcity and diversity. M. E. Soulé. Sunderland, MA, Sinauer Associates**:** 504-515.

Neill, H. R., R. G. Cummings, P. P. Ganderton, G. W. Harrison and T. McGuckin (1994). Hypothetical surveys and real economic commitments. *Land Economics* 70(2): 145-154.

Nisbett, R. E. (1980). The trait construct in lay and professional psychology. Retrospections on social psychology. L. Festinger. New York, Oxford University Press**:** 109-130.

Norman, W. T. (1963). Toward an adequate taxonomy of personality attributes: replicated factor structure in peer nomination personality ratings. *Journal of Abnormal and Social psychology* 66: 574-583.

Norman, W. T. (1967). 2,800 personality trait descriptors: normative operating characteristics for a university population, Department of Psychology, University of Michigan.

NSO (2007). The 2007 household socio-economic survey. Bangkok, National Statistical Office.

Ones, D. S. and C. Viswesvaran (1996). Bandwidth-Fidelity dilemma in personality measurment for personal selection. *Journal of organizational behavior* 17(6): 609-626.

Pacini, R. and S. Epstein (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Personality processes and individual differences* 76(6): 972-987.

Palmquist, R. B. (2004). Weak complementarity, path independence, and the intuition of the WIllig condition. *Journal of Environmental Economics and Management* 49: 103-115.

Panayiotou, G., C. M. Kokkinos and G. Spanoudis (2004). Searching for the ''Big Five'' in a Greek context: The NEO-FFI under the microscope. *Personality and Individual Differences* 36: 1841-1854.

Park, T., J. B. Loomis and M. Creel (1991). Confidence intervals for evaluating benefits estimates from dichotomous choice contingent valuation studies. *Land Economics* 67(1): 64-73.

Paulhus, D. L. (1991). Measurement and control of response bias. Measures of personality and social psychological attitudes. J. P. Robinson, P. R. Shaver and L. S. Wrightsman. San Diego, Academic Press**:** 17-59.

Paulhus, D. L. (2002). Socially desirable responding: The evolution of a construct. The role of constructs in psychological and educational measurement. H. I. Braun, D. N. Jackson and D. E. Wiley. NJ, Erlbaum**:** 49-69.

Pervin, L. A. and D. Cervone (2010). Personality: Theory and research. Ney Jersey, John Wiley and Sons.

Price, C. (2000). Valuation of unpriced products: contingent valuation, cost-benefit analysis and participatory democracy. *Land Use Policy* 17: 187-196.

Raghunathan, R. and M. T. Pham (1999). All negative moods are not equal: Motivational influences of anxiety and sadness on decision making. *Organizational Behaviour and Human Decision Processes* 79(1): 56-77.

Raghunathan, R., M. T. Pham and K. P. Corfman (2006). Informatioinal properties of anxiety and sadness, and displaced coping. *journal of Consumer Research* 32: 596-601.

Rammstedt, B. and O. P. John (2007). Measuring personality in one minute or less: A 10-item short version of the big five inventory in English and German. *Journal of Research in Personality* 41(203-212).

Randall, A. (1994). A difficulty with the travel cost method. *Land Economics* 70(1): 88-96.

Richard, F. D., C. F. J. Bond and J. J. Stokes-Zoota (2003). One hundred years of social psychology quantitiatively described. *Review of General Psychology* 7: 331-363.

Rizzi, L. I. and J. d. D. Ortúzar (2003). Stated preference in the valuation of interurban road safety. *Accident Analysis and Prevention* 35: 9-22.

Roberts, B. W. and D. Mroczek (2008). Personality trait change in adulthood. *Current Directions in Psychological Science* 17(1): 35.

Rolfe, J. and J. Windle (2012). Distance decay functions for iconic assets: Assessing national values to protect the health of the Great Barrier Reef in Australia. *Environmental and Resource Economics* 53: 347-365.

Rolland, J., W. Parker and H. Stumpf (1998). A Psychometric Examination of the French Translations of NEO-PI-R and NEO-FFI. *Journal of Personality Assessment* 71(2): 269-291.

Rothbart, M. K. (2011). Becoming who we are: Temperament and personality. New York, The Guilford Press.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs* 33(1): 300-303.

Roulston, K. (2003). Learning to interview in the social sciences *Qualitative inquiry* 9(4): 643-668.

Rowe, R. D., W. D. Schulze and W. S. Breffle (1996). A test for payment card biases. *Journal of Environmental Economics and Management* 31: 178-185.

Runyan, W. M. (1997). Studying lives. Handbook of personality psychology. R. Hogan, J. Johnson and S. Briggs. London, Academic Press**:** 41-69.

Ryan, A. M. and C. L. Spash (2011). Is WTP attitudinal measure? Empirical analysis of the psychological explanation for contingent values. *Journal of Economic Psychology* 32: 674-687.

Ryan, M., D. A. Scott and C. Donaldson (2004). Valuing health care using willingness to pay: a comparison of the payment card and dichotomous choice methods. *Journal of Health Economics* 23: 237-258.

Ryckman, R. (2008). Theories of personality Belmont, Thomson Wadsworth.

Sagoff, M. (1998). Aggregation and deliberation in valuing environmental public goods: A look beyond contingent pricing. *Ecological Economics* 24: 213-230.

Shevlin, M., J. Miles, M. Davies and S. Walker (2000). Coefficient alpha:A useful indicator of reliability? . *Personality and Individual Differences* 28(2): 229-237

Shrestha, R. K., A. F. Seidl and A. S. Moraes (2002). Value of recreational fishing in the Brazilian Pantanal: a travel cost analysis using count data models. *Ecological Economics* 42(1-2): 289-299.

Soldz, S. and G. Vaillant (1999). The Big Five personality traits and the life course: A 45-year longitudinal study
Journal of Research in Personality 33: 208-232.

Soliño, M. and B. A. Farizo (2014). Personal traits underlying environmental preferences: A discrete choice experiment. *PLoS ONE* 9(2): 1-7.

Sternberg, R. J. and E. L. Grigorenko (1997). Are cognitive styles still in style? *American Psychologist* 52(7): 700-712.

Strazzera, E., M. Genius, R. Scarpa and G. Hutchinson (2003). The effect of protest votes on the estimates of WTP for use values of recreational sites. *Environmental and Resource Economics* 25: 461-476.

Strube, M. J. (1991). Multiple determinants and effect size: A more general method of discourse. *Journal of personality and social psychology* 61(6): 1024-1027.

Svedsäter, H. (2000). Contingent valuation of global environmental resources: test of perfect and regular embedding. *Journal of Economic Psychology* 21: 605-623.

Svedsäter, H. (2003). Economic valuation of the environment: how citizens make sense of contingent valuation questions. *Land Economics* 79(1): 122-135.

Svedsäter, H. (2007). Ambivalent statements in contingent valuation studies: inclusive response formats and giving respondents time to think. *The Australian Journal of Agricultural and Resource Economics* 51: 91-107.

Switzer, G. E., S. R. Wisniewski, S. H. Belle, M. A. Dew and R. Schultz (1999). Selecting, developing, and evaluating research instruments. *Social Psychiatry and Psychiatric Epidemiology* 34: 399-409.

Tietenberg, T. and L. Lewis (2009). Environmental and natural resource economics Boston, Pearson Education.

Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica* 26(1): 24-36.

Trull, T. J. and D. C. Geary (1997). Comparison of the big-five factor structure across samples of Chinese and American adults. *Journal of Personality Assessment* 69(2): 324-341.

Tupes, E. C. and R. E. Christal (1961). Recurrent personality factors based on trait ratings. Washington, DC: U.S. , Government Printing Office.

Van Vaerenbergh, Y. and T. D. Thomas (2012). Response styles in survey research: A literature review of antecedents, consequences, and remedies. *International journal of public opinion research* 25(2): 195-217.

Vartia, Y. O. (1983). Efficient methods of measuring welfare changes and compensated income in terms of ordinary demand functions. *Econometrica* 51: 79-98.

Veisten, K. and S. Navrud (2006). Contingent valuation and actual payment for voluntarily provided passive-use values: assessing the effect of an induced truth-telling mechanism and elicitation formats. *Applied Economics* 38: 735-756.

Venkatachalam, L. (2004). The contingent valuation method: a review. *Environmental impact assessment review* 24: 89-124

Vossler, C. A. and J. Kerkvliet (2003). A criterion validity test of the contingent valuation method: comparing hypothetical and actual voting behavior for a public referendum. *Journal of Environmental Economics and Management* 45(3): 631-649.

Wang, X., J. Bennett, C. Xie, Z. Zhang and D. Liang (2007). Estimating non-market environmental benefits of the conversion of cropland to forest and grassland program: A choice modeling approach. *Ecological Economics* 63(1): 114-125.

Watson, D. and L. A. Clark (1997). Extraversion and its positive emotional core. Handbook of personality psychology. R. Hogan, J. Johnson and S. Briggs. San Diego, Academic Press**:** 767-793.

Webb, E. (1915). Character and intelligence: An attempt at an exact study of character. *The British Journal of Psychology* Monograph Series, 1(3).

Weijters, B., M. Geuens and N. Schilewaert (2010). The individual consistency of acquiescence and extreme response style in self-report questionnaires. *Applied psychological measurement* 34(2): 105-121.

Weisbrod, B. A. (1964). Collective-consumption services of individual-consumption goods. *Quarterly Journal of Economics* 78: 471-477.

Whitehead, J., P. Groothuis, R. Southwick and P. Foster-Turley (2009). Measuring the economic benefits of Saginaw Bay coastal marsh with revealed and stated preference methods. *Journal of Great Lakes Research* 35(3): 430-437.

Whynes, D. K., J. L. Wolstenholme and E. Frew (2004). Evidence of range bias in contingent valuation payment scales. *Health Economics* 13: 183-190.

Wilt, J., K. Oehlberg and W. Revelle (2011). Anxiety in personality. *Personality and Individual Differences* 50: 987-993.

Wilt, J. and W. Revelle (2009). Extraversion. Handbook of individual differences in social behavior. M. R. Leary and R. H. Hoyle. New York, The Guilford Press.

Wiser, R. H. (2007). Using contingent valuation to explore willingness to pay for renewable energy: a comparison of collective and voluntary payment vehicles. *Ecological Economics* 62(3-4): 419-432.

Wood, S. and A. Trice (1958). Measurement of recreation benefits. *Land Economics* 34: 195-207.

Wu, P.-I. and C. Huang (2001). Actual averting expenditure versus stated willingness to pay. *Applied Economics* 33(2): 277-283.

Xu, Z., G. Cheng, J. Bennett, Z. Zhang, A. Long and H. Kunio (2006). Choice modeling and its application to managing the Ejina Region, China. *Journal of Arid Environments*.

Zheng, L., L. R. Goldberg, Y. Zheng, Y. Zhao, Y. Tang and L. Liu (2008). Reliability and concurrent validation of the IPIP Big-Five factor markers in China: consistencies in factor structure between internet-obtained heterosexual and homosexual samples. *Personality and Individual Differences* 45(7): 649-654.

Zuckerman, M. (1991). Psychobiology of personality Cambridge, Cambridge University Press.

Appendix
CVM Questionnaire

Economic benefits of an improvement of the Mae Rim tap water supply

Sawasdee krab/kah

"Chiang Mai University and the University of Hohenheim in Germany are doing research together with the Mae Rim Water Works to examine the possibilities for an improvement of the water supply in Mae Rim. This survey serves to explore the possibilities and the wishes of the population regarding such an improvement. Your household has been randomly selected out of all the customers of the Water Works. We kindly ask you to answer the following questions so that your opinion can contribute to build a better tap water supply system in this region. Your answers will be treated confidentially. This interview will last approximately 45 minutes."

			Yes	No	*Next question*
1-1	**For which purposes do you use the water from the Mae Rim Water Works?**				
	INT.: Please check one number per line.		Yes	No	
	A	Bathing	01	02	
	B	Dish washing	01	02	
	C	Laundering	01	02	
	D	House-cleaning	01	02	
	E	Gardening	01	02	
	F	Cooking	01	02	
	G	Drinking	01	02	if "no" : L
	H	Do you treat the water before drinking?	01	02	if "no" : L
	How do you treat it?				
	I	By filtering	01	02	
	J	By boiling	01	02	
	K	By adding chemicals	01	02	
	L	Others:			

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1-2	**For how many years have you been connected to the water system of the Mae Rim Water Works?**					years	

1-3	**Do you experience problems with the MRW system like e. g. low pressure, interruption of water supply for several hours per day or for entire days?**						
	INT.: Please present the scale	never	rarely	sometimes	often	very often	
A	Low pressure	1	2	3	4	5	
B	Interruption of water supply for several hours per day	1	2	3	4	5	
C	Interruption of water supply for entire days	1	2	3	4	5	

1-4	**What is your average monthly water bill for the water delivered by the Mae Rim Water Works?**	Baht

1-5	**Do you also have a village water system in your village?**	Yes ....01 No 02	1-10

1-6	**Are you connected to this village water system?**	Yes ....01 No 02	1-10

1-7	**For which purposes do you use the water from the village water system?**			
	INT.: Please check one number per line.	Yes	No	
A	Bathing	01	02	
B	Dish washing	01	02	
C	Laundering	01	02	
D	House-cleaning	01	02	
E	Gardening	01	02	
F	Cooking	01	02	
G	Drinking	01	02	if "no" : L
H	Do you treat the water before drinking?	01	02	if "no" : L
How do you treat it?				
I	By filtering	01	02	
J	By boiling	01	02	
K	By adding chemicals	01	02	
L	Others:			

1-8	**What is your average monthly water bill for the village water system?**					Baht	

1-9	**For how many years have you been connected to the village water system?**					years	

1-10	**Do you have installed a water supply system of your own which you use, for example a ground water well or pump etc.**	Yes .... 01 No 02	1-13

1-11	**For which purposes do you use the water from your own water system?**			

INT.: Please check one number per line.

		Yes	No	
A	Bathing	01	02	
B	Dish washing	01	02	
C	Laundering	01	02	
D	House-cleaning	01	02	
E	Gardening	01	02	
F	Cooking	01	02	
G	Drinking	01	02	if "no" : L
H	Do you treat the water before drinking?	01	02	if "no" : L

How do you treat it?

		Yes	No	
I	By filtering	01	02	
J	By boiling	01	02	
K	By adding chemicals	01	02	
L	Others:			

1-12	**How many years ago have you established your own water system?**					years ago -99	

1-13	**Do you have installed a water storage tank system?**	Yes .... 01 No 02	

2	Now let's talk about your drinking water.				
2-1	**Which is the primary source of drinking water in your house or apartment?** *INT: Please check only one of the possibilities.*	MRW water .... 01 Village water system .. 02 Own system .... 03 Bottled water delivered to your house/apt. .... 04 Bottled water bought in the store .... 05 Other 06		3-1 3-1 3-1 3-1 3-1	
2-2	**What are the reasons for choosing your primary source of drinking water?**				
	INT.: Please check one number per line.		Yes	No	
	A	All other sources are hazardous to my health.	01	02	3-3
	B	It has the best quality.	01	02	3-3
	C	It tastes better than the others.	01	02	3-3
	D	It is the cheapest source.	01	02	3-3
	E	It is more convenient than the other sources.	01	02	3-3
	F	I have always used this source.	01	02	3-3
3-1	**How would you characterize the quality of the drinking water from your primary source?** **Please specify with the help of the scale.**	very poor...................... 01 poor .... 02 just o.k. .... 03 good .... 04 excellent .... 05 Do not know 06			
3-2	**What are the reasons for choosing your primary source of drinking water?**				
	INT.: Please check one number per line.		Yes	No	
	A	All other sources are hazardous to my health.	01	02	
	B	It has the best quality.	01	02	
	C	It tastes better than the others.	01	02	
	D	It is the cheapest source.	01	02	
	E	It is more convenient than the other sources.	01	02	
	F	I have always used this source.	01	02	

| 3-3 | **How much money do you spend on average per month on bottled drinking water?** | Baht | |

| 4 | **Now we would like to talk about the MRW water service** | |

| 4-1 | **How would you characterize the overall quality of the water of the MRW water system?**

Please specify with the help of the scale. | very poor...................... 01

poor 02

just o.k. 03

good 04

excellent 05

Do not know .... 06 | |

| 4-2 | **Do you have installed a filter for purifying the MRW water?** | Yes 01

No .... 02 | |

4-3 We would like to know your opinion regarding some specific characteristics of MRW water. Please, tell us how worried you are about these characteristics using the following scale.

INT.: Please present the scale		not worried at all	little worried	sometimes worried	quite worried	very worried
A	Taste	1	2	3	4	5
B	Color	1	2	3	4	5
C	Odor	1	2	3	4	5
D	Other:	1	2	3	4	5

4-4 When you think about drinking the MRW water how worried are you about getting the following diseases?

INT.: Please present the scale		not worried at all	little worried	sometimes worried	quite worried	very worried
A	Diarrhea	1	2	3	4	5
B	Kidney stones	1	2	3	4	5
C	Cancer	1	2	3	4	5
D	Other:	1	2	3	4	5

| 4-5 | **Have you or has somebody in your family ever become ill from the MRW water?** | Yes 01

No .... 02 | |

Project scenario

Chiang Mai University, the University of Hohenheim and the Mae Rim Water Works (MRW) are currently surveying water users' interests in the program "Drinkable Tap Water-Clean Stream". The idea is that all MRW customers should enjoy an uninterrupted supply of tap water which is also drinkable. "Drinkable Tap Water-Clean Stream" consists of two main programs which are the improvement of the MRW distribution system and an improvement of upstream water quality as the source of the MRW water.

INT.: Show photograph card

An improvement of the MRW distribution system is necessary because of frequent pollution with biological pollutants in the area due to broken pipes in the distribution system. Biological pollutants might cause diarrhea or other diseases. The broken pipes are also responsible for frequent interruptions of water service which occur in some parts of Mae Rim.

An improvement of upstream water quality is necessary to ensure that MRW receives good water for treatment and distribution to the households. There are two main problems regarding the upstream water quality: the first is the red color of the water which occurs often in the rainy season and the second is the contamination with pesticides which might lead to severe health damages like for example cancer. The red color of the water is caused by soil erosion in the uplands of the Mae Sa valley. Pesticides in the water are an immediate consequence of their high use in the uplands of the Mae Sa valley. As you can see from this map, your tap water originates exclusively from the rivers of the Mae Sa valley.

INT.: Show map of the watershed

The program "Drinkable Tap Water-Clean Stream" could be implemented in the following way: First, the pipe system could be mended and maintained so that biological pollution and interruption of water supply would stop. Second, an effective soil conservation program could be implemented so that soil erosion would be stopped in the uplands. Third, pesticide use in the uplands could be reduced for example by employing a more adapted and targeted pest control system.

INT.: If respondent asks about the new Ping River pumping station, please explain: "For this survey only households receiving their tap water exclusively from the Mae Sa were selected."

If these proposed measures were carried out additional benefits for the whole population of Mae Rim would result. For example, it is well known that progressive soil erosion in the uplands leads to sedimentation in the lowlands and, as a consequence, to a high risk of flooding in the rainy season. Stopping soil erosion in the uplands with this program would, therefore, reduce the risk of flooding in the Mae Rim area. Similarly, this program would also reduce the contamination of fruits and vegetables with pesticides. Also, the accumulation of pesticides in the surrounding ecosystems would be stopped so that future harm to plant and animal life will be prevented and the health of future generations will not be threatened by these pesticides. Therefore, from the proposed measures the whole population of Mae Rim and future generations in this area would benefit.

Brochure given to CVM respondents during the interviews

Broken pipes in the MRW water distribution system frequently cause pollution with biological pollutants in the area. Biological pollutants can cause diarrhea or other diseases. The broken pipes are also responsible for frequent interruptions of water service which occur in some parts of Mae Rim. For these reasons it is necessary to have <u>an improvement of MRW tap water distribution system.</u>

Figure1 Broken pipes in the area

Figure2 Red color of Mae Sa river

Figure3 Soil erosion in the Mae Sa valley

Red color of the water which occurs often in the rainy season is caused by soil erosion in the uplands of the Mae Sa valley. This red water later will affect tap water quality of MRW therefore it is necessary to have <u>an improvement of upstream water quality</u> to ensure good quality of tab water in the downstream.

Pesticides in the water are an immediate consequence of their high use in the uplands of the Mae Sa valley. Contamination of the tap water with pesticides might lead to severe health damages like for example cancer. <u>An improvement of upstream water quality</u> will also ensure the reduction pesticide contamination in the tap water.

Figure4 Pesticide application in the Mae Sa Valley
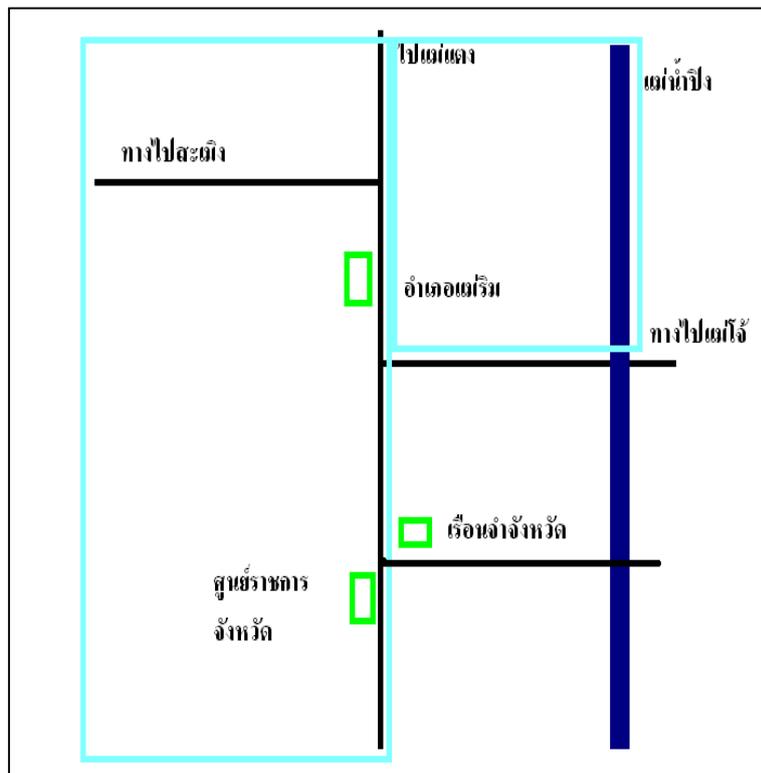
Figure5 Areas where tap water is produced from Mae Sa water

As you can see from this map, your tap water originates exclusively from the rivers of the Mae Sa valley and therefore it might be possible that your tab water is receiving some of the mentioned consequences.

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5		**Now we would like to know how important the elements of the described program are for yourself.**						
		INT.: Please present the scale	not important at all	not so important	fairly important	important	very important	
	A	no interruptions of water service	1	2	3	4	5	
	B	no biological pollutants in the tap water	1	2	3	4	5	
	C	no pesticides in the tap water	1	2	3	4	5	
	D	clear color of the water	1	2	3	4	5	
	E	reduced flooding in the Mae Rim area	1	2	3	4	5	
	F	less soil degradation in the uplands	1	2	3	4	5	
	G	no accumulation of pesticided in the ecosystems	1	2	3	4	5	
	H	less pesticides in fruits and vegetables	1	2	3	4	5	
	I	reduced health threats for future generations	1	2	3	4	5	

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Double-bounded DC, for the initial bid designs see table 5-1

6a	Since these measures are costly their financing has to be secured before such a program can be implemented. Therefore, it is intended to introduce a monthly surcharge on the MRW water bill for the next five years to get the program started. The surcharge will be equal for all households connected to the MRW system. Would you be willing to support this program if your household had to pay 50 Baht per month for the next five years?	Yes .... 01 No 02	6b 6c
6b	If it turns out that this program would cost your household 100 Baht instead, would you also be willing to support the program?	Yes .... 01 No 02	7 7
6c	If instead the monthly surcharge were only 25 Baht, would you then be willing to support this program?	Yes .... 01 No 02	

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7	**Did you personally find it difficult to make a decision about your contribution to the improvements?**		very easy 01
			quite easy 02
			neutral 03
	INT.: Please present the scale.		difficult 04
			very difficult 05

8	**How true are the following considerations with respect to your decision on the amount to contribute to the improvements of tap water supply?**						
	INT.: Please present the scale		not true at all	mostly not true	partly true	mostly true	fully true
	A	I will be able to save money since I don't have to buy bottled water or to use the water filter any more.	1	2	3	4	5
	B	It is more convenient to get all my water from the tap.	1	2	3	4	5
	C	My household will not run the risk of becoming ill from the tap water any more.	1	2	3	4	5
	D	I never felt at ease with the red color of the tap water and want to contribute to stop it.	1	2	3	4	5
	F	It gives me a good feeling to know that future generations will live in a healthier environment.	1	2	3	4	5
	H	I would like to pay for this improvement but I cannot afford it.	1	2	3	4	5
	I	I have severe doubts that these improvements can be realized as described.	1	2	3	4	5
	J	I think government is responsible for such a program and should pay for it.	1	2	3	4	5
	K	My water costs are already high enough. We should receive the good quality service without additional costs.	1	2	3	4	5

9	**Do you think that the following facilities and institutions should be financed by taxes? Please be aware of the fact that all government spendings require the imposition of taxes to raise the necessary funds.**		
	INT.: Please check one number per line	Yes	No
A	Libraries	01	02
B	Discotheques	01	02
C	State Railway of Thailand	01	02
D	Swimming-pools, gyms, sports fields	01	02
E	Schools	01	02
F	Provincial Electricity Authority	01	02
G	Theater	01	02
H	Provincial Water Authority	01	02
I	Mass Transit Authority	01	02
J	Thailand Post	01	02
L	Telephone of Thailand	01	02

10	**To what extent do you feel emotionally attached to…**					
	INT.: Please present the scale	not attached at all	little attached	fairly attached	attachd	very attached
A	… your village?	1	2	3	4	5
B	… Mae Rim?	1	2	3	4	5
C	… Chiang Mai Province?	1	2	3	4	5
D	… Northern Thailand?	1	2	3	4	5
E	… Thailand as a whole?	1	2	3	4	5

11	**How often do you…**					
	INT.: Please present the scale	never	rarely	sometimes	often	very often
A	… lend money to somebody who is not a member of your family?	1	2	3	4	5
B	… donate for a good social cause?	1	2	3	4	5
C	… donate to an environmental organization?	1	2	3	4	5

12	**To what extent do the following statements apply to you?**						
	INT.: Please present the scale		never	rarely	sometimes	often	very often
	A	I find it difficult to say "no" if a friend asks me a favor.	1	2	3	4	5
	B	It gives me a good feeling if I donate money for people I do not know personally, for example for old people, disabled people or orphans	1	2	3	4	5
	C	The increase of my "boon" associated with the donation is very important to me.	1	2	3	4	5
	D	I help other people because they will help me when I am in need.	1	2	3	4	5
	E	I donate money because "giving" is an established habit in our society.	1	2	3	4	5
	F	I promise to do something although I do not want to do it.	1	2	3	4	5
	G	I give promises and then I do not keep them.	1	2	3	4	5
	H	I am concerned what other people might think of me.	1	2	3	4	5
13	**To what extent do you agree with the following statements?**						
	INT.: Please present the scale and check one number per line.		do not agree at all	do not agree	quite agree	agree	fully agree
	A	Taking care of environmental protection is an important task of government.	1	2	3	4	5
	B	Law enforcement concerning environmental management is usually not effective.	1	2	3	4	5
	C	Usually, government's action concerning environmental protection is 'too late'.	1	2	3	4	5
	D	Government should collect more taxes to increase the budget for environmental management.	1	2	3	4	5

14		How satisfied are you with the following areas of your life?					
		INT.: Please present the scale	not satisfied at all	not so satisfied	some-what satisfied	mostly satisfied	very satisfied
	A	Your health?	1	2	3	4	5
	B	Your work?	1	2	3	4	5
	C	The income of your household?	1	2	3	4	5
	D	Your apartment / your house?	1	2	3	4	5
	E	Your free time?	1	2	3	4	5
	F	Your family life?	1	2	3	4	5
	G	Your standard of living altogether?	1	2	3	4	5
	H	Your life altogether?	1	2	3	4	5

15	**How would you classify the economic situation of your household?** INT.: Please present the scale.	very poor .... 01 poor .... 02 neither rich, nor poor.... 03 rich .... 04 very rich 05	
16	**How do you judge the economic situation of your household in comparison with the average households in Mae Rim?** INT.: Please present the scale.	much worse .... 01 a little worse .... 02 average...................... 03 a little better .... 04 much better 05	
17	**How fair do you consider your household income in comparison with other households' incomes?** INT.: Please present the scale.	not fair at all .... 01 not so fair................... 02 somewhat fair............. 03 basically fair .... 04 very fair 05	

18		**To what extent are the following statements true regarding your personal situation?**					
		INT.: Please present the scale	not true at all	not so true	fairly true	mostly true	completely true
	A	I need a lot of money because I want to have fun.	1	2	3	4	5
	B	I could not be happy without money.	1	2	3	4	5
	C	I usually spend all my income because buying things makes me happy.	1	2	3	4	5
	D	I like to buy things on installment.	1	2	3	4	5
	E	I build up savings because I want to have security for the future.	1	2	3	4	5
	F	I build up savings because I want to leave something for my children.	1	2	3	4	5
	G	Even with more money for myself I would not be happier than now.	1	2	3	4	5

19		**We would like to know, if you are a member of the following organizations.**		
		INT.: Please check one number per line.	Yes	No
	A	Are you a member of a social institution?	01	02
	B	Are you a member of a citizens' action group?	01	02
	C	Are you a member of a political party?	01	02

20		**How interested are you in the following areas? Please answer the following questions using the scale.**					
		INT.: Please present the scale	not interested at all	not so interested	fairly interested	mostly interested	very interested
	A	Local politics	1	2	3	4	5
	B	Situation of the Thai economy	1	2	3	4	5
	C	Environmental issues	1	2	3	4	5
	D	Public health, like the fight against the bird flu	1	2	3	4	5
	E	Matters of social justice	1	2	3	4	5

21		**To what extent are you worried about the following issues?**					
		INT.: Please present the scale	not worried at all	little worried	somewhat worried	quite worried	very worried
	A	About your own economic situation	1	2	3	4	5
	B	About your health	1	2	3	4	5
	C	About the progressive degradation of the environment	1	2	3	4	5
	D	About peace in the world	1	2	3	4	5
	E	About the political situation in our country.	1	2	3	4	5
	F	About the security of your income	1	2	3	4	5
	G	About the erosion of moral values among young people	1	2	3	4	5
	H	About the decrease in social justice in our country	1	2	3	4	5
	I	About corruption	1	2	3	4	5
	J	About too many foreigners living in Thailand	1	2	3	4	5

Now we would like to ask you some personal questions.

22-1		**Do you have any debts from…**		
		INT.: Please check one number per line.	Yes	No
	A	… the bank or the BAAC?	01	02
	B	… your friends or your family?	01	02
	C	… private money lenders?	01	02
	D	… others such as cooperative or village fund?	01	02
	E	… delayed payments or installment payments?	01	02

22-2	*INT: if at least one of the questions in 22-1 was "yes" ask:*	less than 20000 Baht .... A
	What is the level of your indebtedness? Please include also installment debts. Please select from the given brackets.	20000 up to less than 50000 Baht .... B
		50000 up to less than 100000 Baht C
		100000 up to less than 200000 Baht ..... D
	otherwise continue with question 23-1.	200000 up to less than 300000 Baht ..... E
		more than 300000 Baht .... F

22-3	**What did you use the money for?**			
	INT.: Please check one number per line.		Yes	No
	A	Buying a house	01	02
	B	Buying a new car	01	02
	C	Buying furniture and household appliances	01	02
	D	Buying other consumption goods	01	02
	E	Making an investment	01	02
	F	Supporting friends or family	01	02

22-4	**Are you worried about your debts?**	Yes............................ 01
		No 02

23-1	*INT.: Please fill in without inquiry*	male 01	
	Sex of the respondent:	female 02	
	INT.: If the questions are answered by two persons, e.g. husband and wife, with different sexes, please check "03".	answered by couple 03	
		-99	

23-2	**Were you born in Thailand?**	Yes............................ 01	
	INT: If answered by couple both categories can be checked if necessary.	No 02	23-4

23-3	**In which province?**		
	INT: If answered by couple write down two provinces if necessary.	....	
		(INT.: please write down) -99	

23-4	**When were you born? Please state the year of your birth.**	
	INT: If answered by couple also write down year of birth of the partner	
	_____	

23-5	**What marital status do you have?** **What applies to you from this list?** *INT.: Please present the list.*	I am married and live together with my spouse 01	
		I am married and live separated from my spouse 02	
		I am not married 03	
		I am divorced 04	
		I am widowed 05	
23-6	**Do you have children or even grandchildren?**	Yes........................... 01	
		No 02	
23-7	**How many persons are constantly living in your household, including yourself? Please consider all the children in the household.**	Person(s)	
23-8	*INT.: ask only households with at least 2 persons.* **How many persons living in your household contribute to your household income?**	Person(s)	
23-9	**Which is your highest level of education?** **Please give your answers according to the list.** *INT.: Please present the list.* *INT: If answered by couple you may check two different categories if necessary.*	I left the school without certificate 01	
		4th year of elementary school 02	
		6th year of elementary school 03	
		3rd year of secondary school 04	
		6th year of secondary school 05	
		Technical Education Certificate 06	
		Higher Technical Education Certificate............ 07	
		The bachelor degree...................................... 08	
		The master degree 09	
		I have obtained a PhD 10	
		I have a different certificate: .... 11 *(INT.: Please write down)*	

23-10	**What kind of job do you do at present?** *INT.: Please present list.* *INT: If answered by couple you may check two different categories if necessary.*	Worker / employee 01	
		Official 02	23-12
		Owner or renter of a farm................................ 03	23-12
		Self-employed... 04	23-12
		Trainee, student, pupil 05	23-12
		Housewife, househusband 06	23-12
		Retiree, early retirement 07	23-12
		Unemployed... 08	23-12
23-11	**Are you employed full-time or part-time?** *INT: If answered by couple you may check both categories if necessary.*	Full-time............... 01 Part-time 02	
23-12	**What is the average net monthly income of your household altogether?** **Please state the sum of wages, incomes from self-employment and pensions minus tax payments and social security insurance. Please also add the income from public subsidies, rents, housing subsidies, child benefits, and other sources of income.** **If you are responsible for the support of a part of your family not living in your household, please deduct this amount. Your statement will be treated confidentially.** *INT.: Please present the list.*	less than 6000 Baht .... A 6000 up to less than 10000 Baht........... B 10000 up to less than 20000 Baht .... C 20000 up to less than 30000 Baht .... D 30000 up to less than 50000 Baht .... E more than 50000 Baht .... F	

Thank you very much for answering these questions!

I assure that I carried out this interview according to the given instructions.

Signature of the interviewer

Date

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Nopasom Sinphurmsukskul

Professional experience/ Awards

2010-2014	**Colonel Kasem Nanthakit Foundation**	**Bangkok, Thailand**

Scholarship holder

2006-2009	**The Uplands Program**	**Chiang Mai, Thailand**

Research associates
- Research associates in a research project titled "Economic valuation of environmental improvements in Northern Thailand and Vietnam."

2003-2006	**The Uplands Program**	**Chiang Mai, Thailand**

Research associates
- Research associates in a research project titled "Tenure and economic valuation of common-pool resources in mountainous regions of Thailand and Vietnam."

2000-2001	**Stuttgarter Hofbräu Stiftung**	**Stuttgart, Germany**

Scholarship holder

1998-2000	**Sanwa Bank Foundation**	**Tokyo, Japan**

Scholarship holder

Education/ Degrees

2015	**University of Hohenheim**	**Stuttgart, Germany**

- Ph.D. candidate
- Dissertation titled "Personality-based approach to environmental valuation."

2000-2002	**University of Hohenheim**	**Stuttgart, Germany**

- M.Sc. Food Security, Natural Resources Management in the Tropics and Subtropics
- Master thesis titled "Impact analysis of microcredit project in northeast Thailand: A case study of Thai-German Development Foundation."

1996-2000	**Chiang Mai University**	**Chiang Mai, Thailand**

- Bachelor degree in Economics
- Graduated with First Class Honors

1990-1996	**Vajiravudh College**	**Bangkok, Thailand**

- Secondary school certificate

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gemäß § 8 Absatz 2 Buchstabe b) der Promotionsordnung der Universität Hohenheim zum Dr. oec. und Dr. rer. soc.

1. Bei der eingereichten Dissertation zum Thema

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