UNIVERSITÄT HOHENHEIM
Fakultät Wirtschafts- und Sozialwissenschaften

Freie wissenschaftliche Arbeit zur Erlangung des akademischen Grades Dr. Oec.

Contingent Valuation and Money Attitudes

Eingereicht am Lehrstuhl für VWL, insbes. Umweltökonomie sowie Ordnungs-, Struktur- und Verbraucherpolitik, Volkswirtschaftliches Institut (520F)
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Abgabe: Stuttgart, 27. Juli 2015
Tag der mündlichen Prüfung: 20. November 2015

LIST OF ABBREVIATIONS

AV	Altruistic value
BV	Bequest value
CEG	Citizen Expert Group
CS	(Hicksian) Compensating Surplus
CV	(Hicksian) Compensating Variation
CVM	Contingent Valuation Method
DC	Dichotomous Choice (value elicitation format)
DSS	Decision Support System
ES	(Hicksian) Equivalent Surplus
EV	(Hicksian) Equivalent Variation
GDP	Gross domestic product
GT	The General Theory of Employment, Interest and Money (Keynes, 1936)
HPM	Hedonic Price Method
MAS	Money Attitude Scale
MBBS	Money Beliefs and Behaviour Scale
MES	Money Ethics Scale
NOAA	National Oceanic and Atmospheric Administration
OLS	Ordinary Least Squares
OV	Option value
PoP	Pain of Paying
SuMaRiO	Sustainable Management of River Oasis along the Tarim River
TCM	Travel Cost Method
TEPP	Tarim Environmental Preservation Plan
WTA	Willingness to Accept (compensation)
WTP	Willingness to Pay
XV	Existence value

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1 Introduction

Complaints about environmental pollution, discussions about the adverse impacts of global climate change and calls for more environmental protection are nowadays omnipresent in most developed countries. Governments spend billions of euros yearly to meet people's demand for the protection and restoration of our natural environment. However, given limited public funds on the one hand and the high costs of environmental projects on the other, policy makers have to justify their decisions when implementing measures aimed at enhancing environmental quality. European Union regulations, for example, oblige the member states to carry out cost-benefit assessments prior to the implementation of major environmental projects. For this purpose, the costs and benefits accruing to society from a particular project have to be quantified and compared to each other. To ensure an efficient allocation of public funds, only those environmental projects which are expected to generate higher benefits than costs should be realised. In the environmental sector, cost assessments are relatively simple. The main factors which make environmental projects costly are inputs like labour, capital and materials as well as forgone economic opportunities; the total costs of an environmental project can be computed based on market prices of these factors. The benefits accruing from environmental projects to society, such as improved air quality, enhanced landscape beauty or the protection of rare plant and animal species, are more complicated to assess. These 'environmental goods' often lack an observable indicator of value. This is because most environmental goods fall into the category of so-called non-market goods, i.e. valuable things which are not traded in markets and therefore have no market price. However, knowledge about the monetary value of environmental goods is essential for the appraisal of projects with substantial environmental impacts.

To overcome this problem economists have developed different environmental valuation methods. These methods take up a very basic concept which is also used when determining the value of goods traded in markets. The price of a market good indicates the minimum amount consumers are willing to pay for this good. Willingness to pay (WTP), in return, directly relates to the utility increase an individual expects to experience when consuming the good. A rational individual will only purchase a particular good for a given price if the utility gained from consuming this good exceeds the utility loss resulting from a decreased income. Hence, the act of spending money reveals that an individual is better off consuming a particular good than not consuming it. Following this idea, environmental valuation methods aim to assess people's WTP for environmental goods. These methods can be broadly divided into revealed preference techniques and stated preference techniques. Revealed preference techniques draw inference from people's actual choices on markets that are somehow related to the environmental good of concern. For example, money spent on a visit of a national park reveals people's appreciation of the plants, animals and natural sceneries that they can enjoy in this park. Stated preference techniques assess environmental values in a more direct way, namely by asking the affected population about their preferences for a particular environmental good. Stated preference techniques

make use of extensive surveys during which respondents are introduced to a hypothetical market scenario, which offers them the opportunity to 'buy' a particular environmental good. Self-report payment intentions are expected to indicate individuals' true WTP for the environmental good in question.

Revealed and stated preference techniques have in common that they provide monetary values of goods that lack a market price. Based on such figures the social benefit of an environmental project can be estimated and straightforwardly used as an input for a comprehensive project appraisal, since benefits and costs are expressed in the same units (i.e. money). The striking difference between the two kinds of environmental valuation approaches is that they account for the preferences of different groups of beneficiaries. While revealed preference techniques exclusively capture the preferences of the users of a particular good, i.e. those spending money on the related market, stated preference techniques can assess the preferences of a broader range of beneficiaries. The winners of environmental improvements encompass people who use the environmental good in question and, in many cases, also individuals who enjoy the environmental good without actively using it. For example, not only the visitors of a national park can be expected to appreciate its maintenance but also people who have never visited it and do not even plan a visit in the future may wish to conserve the park. Like the maintenance or expansion of a national park many environmental projects generate considerable non-use benefits, such as their positive effects for the wellbeing of future generations. Since revealed preference techniques ignore such passive benefits, decision makers should favour stated preference approaches to determine the social benefits of environmental projects.

For environmental assessments, the Contingent Valuation Method (CVM) is the most frequently used stated preference technique and also constitutes the focus of this dissertation. The overall objective of a CVM study consists of assessing individual utility changes resulting from an environmental change. Afterwards these individual welfare measures are aggregated in order to approximate the social benefit (or cost) of a change in environmental quality. Individual utility gains are typically assessed by directly asking the participants of a representative household survey to state how much money they are willing to pay for the realisation of a particular environmental project that is expected to enhance their wellbeing. WTP statements serve as a basis for approximating the social value of environmental improvements which is typically calculated by multiplying the average WTP of a representative sample by the total number of households affected by the environmental improvement in question. Closely following the valuation of market goods, CVM takes up the idea that respondents' WTP refers to the utility they derive from enjoying, actively or passively, the environmental good under consideration.

Since its first applications in the 1960s, CVM has always been prone to a lot of criticism. Critics suspect this survey-based method to produce biased value estimates, i.e. WTP statements that do not reflect individuals' true preferences for environmental improvements. Literature demonstrates that this bias can take different directions, namely over- and understatement of actual WTP (c.f. Venkatachalam, 2004). Given the observation that hypothetical payments fre-

quently exceed actual payments, much research has focussed on explaining why people tend to overstate their WTP for environmental goods. One explanation is that people tend to overlook their budget constraint when being asked a payment question in the context of a CVM interview (e.g. Hausman, 2012). Other researchers have pointed to strategic reasons, such as exaggerating one's WTP in the hope of increasing the likelihood of having the environmental project realised and, at the same time, not being obliged to pay the stated amount (e.g. Carson and Groves, 2007). In addition to explaining why respondents may overstate their actual WTP, motives for understatement have also been explored. In this context another form of strategic behaviour, namely free-riding, has been in the focus of debates (e.g. Whittington et al., 1992). Furthermore, negative attitudes towards some aspect of the environmental project and the related payment have been shown to negatively affect stated WTP (e.g. Jorgensen and Syme, 2000). Another potential source of downward bias is the presence of respondents who refuse to spend money in general. Extremely stingy individuals can be expected to state a zero WTP, not because they do not appreciate the prospective environmental improvement or because they prefer to spend their money on other purposes than the environmental project, but because of the exaggerated importance they attach to accumulating their financial resources. In the latter case WTP is not a genuine expression of preferences for an environmental good but some misleading outcome of people's money attitudes. Even though money plays such a central role in CVM studies, both as a measuring rod and as a means of payment on the hypothetical market, the relationship between people's money spending dispositions and stated WTP has never been addressed in the environmental valuation literature. The present study attempts to reduce this lack of research.

WTP statements reflecting people's refusal to spend money in general rather than their appreciation of the environmental good to be valued pose problems because they risk distorting the overall survey result. If a significantly large share of respondents states a zero WTP that is unrelated to the environmental project of concern, the CVM study may trigger a wrong project appraisal. Decision makers might mistakenly reject an environmental project that would actually enhance society's wellbeing for the mere reason that some stingy respondents have misreported their WTP so that the CVM survey underestimates the actual benefit of this project. The risk of misjudging the welfare effects of environmental projects underlines the need to scrutinise money spending dispositions in CVM surveys. The occurrence of understatement may be reduced by informing the respondents about the hypothetical nature of the payment question, for example by letting them know that existing funds will be used to finance the project and that no additional money will be collected from households. Obviously, such cheap talk risks to make the survey implausible, implying that more respondents give meaningless answers when asked about their WTP than in the case of a realistic and consequential survey. A promising alternative consists of identifying stingy respondents subsequent to the data collection, to verify whether their WTP statements are meaningful or not and discarding biased WTP statements from the data. For this purpose analysts require a suitable tool to measure respondents' attitudes towards spending, for example a particular set of auxiliary questions.

However, given the absence of CVM studies on this topic, there is no established standard regarding the identification and treatment of the supposedly meaningless WTP statements of stingy respondents. Apart from the lack of research in the environmental valuation context, economic literature is generally rather silent about individual differences in money spending habits. In economics, spending much or spending little is typically explained in terms of people's budget constraint and their preferences for present and future consumption. Psychological factors, such as the pleasure derived from retaining one's financial resources, are mostly absent in micro- as well as macroeconomic analysis. Psychological literature, in contrast, points to a number of money-related personality traits and attitudes that are, in addition to economic motives and constraints, supposed to affect people's spending behaviour. Researchers with psychoanalytical background have extensively described the habits of a group of people who have been labelled 'misers' (Kaufman, 1956), 'compulsive savers' (Goldberg and Lewis, 1978) or 'tightwads' (Prelec and Loewenstein, 1998). Individuals belonging to the latter group share an extremely strong inhibition against spending money in general. The latter kind of attitude is, according to psychological theory, essentially unrelated to people's financial means and preferences for consumption but rooted in some less palpable desire for money as such. Furthermore, social psychologists have attempted to measure money attitudes empirically. With the rise of psychometric money attitude inventories, such as Yamauchi and Templer's (1982) 'Money Attitude Scale' or Furnham's (1984) 'Money Beliefs and Behaviour Scale', it is nowadays possible to analyse individual difference in money spending dispositions in a broader than the clinical context and to relate them, for example, to saving habits (see e.g. Hayhoe et al., 2012), charitable giving (Wiepking and Breeze, 2012) and more general consumption patterns (Rick, 2008). Still, the relationship between money attitudes and stated WTP remains to be explored.

One explanation why this topic has not attracted researchers' interest so far might be the fact that no actual transactions take place during a CVM interview. The payment question is purely hypothetical and respondents make no actual commitment when stating their WTP. Thus, one may doubt whether people who are reluctant to spend money on real markets behave the same way in a hypothetical interview situation. Furthermore, a strong inhibition against spending can be expected to be a rather rare phenomenon in most societies. Accordingly, the share of misers in the population might be so small that it is of no statistical relevance for the overall result of a CVM survey. For example, if the group of misers makes up less than 5% of a population, their potentially biased WTP statements would hardly affect the sample's average WTP. At the same time, there are also good reasons why a person's disposition to spend money in general may influence his or her decision regarding a hypothetical payment for an environmental project. The first reason stems from the guidelines of best practise regarding the design of the hypothetical market presented in a CVM survey (e.g. Arrow and Solow, 1993). In order to obtain meaningful WTP statements, the hypothetical market should resemble an actual purchase situation as closely as possible. Hence, if respondents perceive the payment scenario as realistic and consequential, i.e. if they believe that there will be actual payments for the environmental good and that their

WTP statements may decide the monetary amount to be paid, their behaviour should resemble their habits in a real purchase situation. Therefore, it is to be expected that a person who cares little about spending money states a higher WTP than a stingy respondent, even if both of them anticipate the same benefit from enjoying the environmental improvement. Moreover, the socio-cultural context of the present study renders the analysis of the effect of money spending dispositions on WTP particularly interesting. The empirical part of this dissertation deals with the assessment of the social benefit of an environmental restoration project in Northwest China and hence with the monetary value Chinese respondents assign to this project. Strong inhibition against spending money in general may be particularly widespread among Chinese people. This is because thrift and frugality are core values in Confucianism, which is one of the most influential ethical systems in China. Before the rapid development of China's market economy Chinese people considered thrift as a virtue (cf. Hofstede and Bond, 1988, Faure and Fang, 2008). Today, modern values, like materialism and ostentatious consumption, seem to dominate the traditional value of thrift (c.f. Faure and Fang, 2008). However, even nowadays Chinese children are taught at school to retain their money and read in textbooks about the importance of thrift and frugality (cf. Chan, 2006). Hence, it is to be expected that Chinese people act stingier than individuals who grew up in societies that attach less importance to these values. Accordingly, maybe to a greater extent than in western countries, WTP statements are likely to be influenced by Chinese respondents' attitudes towards spending money in general. Taken together, the realistic design of the payment question as well as the socio-cultural context of the CVM survey to be analysed in this dissertation add to the relevance of exploring respondents' money spending dispositions.

The present work attempts to scrutinise the psychological concept of money attitudes and to analyse it in an economic context. It explores the role of people's disposition to spend money, including the extreme case of miserliness, in CVM studies theoretically and empirically. The question whether or not the desire for accumulating money threatens the validity of the results of CVM surveys will receive particular attention. The empirical analysis of people's spending dispositions requires the identification and adaptation of a suitable instrument to measure this hitherto overlooked respondent characteristic in a CVM survey. The effect of miserliness on WTP statements will then be analysed econometrically, using data gathered from a CVM study conducted in Beijing in autumn 2013.

The remainder of this study succeeds as follows: After the general introduction to contingent valuation and money attitudes in the present chapter, the economic valuation of environmental goods is introduced in more detail in chapter 2. The first section addresses the purpose of conducting environmental valuation studies, the economic concept of environmental values as well as different valuation methodologies. As a stated preference technique, contingent valuation is a particularly useful technique for assessing the so-called total economic value, including use and non-use components, of an environmental project. The second section therefore looks at this particular method in more depth. It offers an overview of the theoretical underpinning of CVM.

Finally, the third section focuses on more practical issues, including the design of CVM surveys and validity assessment of WTP data. It concludes with a discussion of several sources of bias that may affect the results of a CVM survey, including the possibly distorting effects of people's attitudes towards spending money.

Since the present study aims to analyse the psychological concept of money attitudes in the context of an economic methodology, the role that money plays in the two scientific disciplines of concern, which are economics on the one hand and psychology on the other, needs to be well understood. Chapter 3 therefore sheds light on the concept of money in economics. It exposes the traditional approach to explain the origins of money and illustrates how the so-called neutrality postulate has shaped both the micro- and the macroeconomic branches of the discipline. While money is mostly analysed as a medium of exchange which does not affect people's behaviour, a number of behavioural economists have stressed the relevance of analysing individual differences in spending money when predicting people's consumption choices. Two behavioural economic contributions dealing with money and miserliness have been identified as particularly enlightening in this context, namely Schmölders' (1982) 'Psychology of Money' and the 'Pain of Paying' (Prelec and Loewenstein, 1998, Rick, 2013). The last section of the chapter comprehensively reviews these two frameworks. Chapter 4 focuses on psychological research on money. In psychology, people's behaviour with money has been primarily analysed by researchers with psychoanalytical background. The corresponding literature explores extreme patterns like hoarding, compulsive bargaining, overspending and gambling. Furthermore, social psychologists have developed money attitude inventories, i.e. scales that measure different money attitude facets. As it turns out in the course of the chapter, money retention, i.e. a strong inhibition against spending money on any purpose in any situation, is a recurrent theme in psychological literature on money.

Following the reviews of the economic and psychological literature on money and miserliness, the two approaches of analysing people's behaviour with money shall be consolidated and put into the environmental valuation context in chapter 5. The first section compares and contrasts the economic and the psychological approach to analyse individuals' behaviour with money. This undertaking encompasses a comprehensive analysis of the most frequently discussed money attitude facets, which are 'power', 'foresight' and 'miserliness', thereby questioning whether these three money attitude facets are likely to systematically affect and potentially distort an individual's WTP for environmental improvements. As argued in this section, only miserliness can be expected to systematically affect and possibly distort WTP. The second section presents two possibilities of integrating miserliness into the economic theory of consumer choice. Both approaches imply a negative effect of miserliness on WTP. However, the two approaches lead to different conclusions regarding the question whether or not miserliness causes bias. To explore whether miserliness only affects WTP or also threatens its validity, the effect of this money attitude facet on WTP has to be explored empirically. The chapter ends with a

presentation of research questions and hypotheses regarding the role of money attitudes in CVM surveys.

These research questions and hypotheses will be addressed empirically in chapter 6. The chapter builds on a case study, which is the Sino-German research project SuMaRiO. The first section introduces the general background of this research project. The second section focuses on a CVM survey carried out in the context of this project, which aimed to assess Beijing citizens' WTP for more sustainable oasis management in the Tarim Basin. The third section summarises some general results of this CVM study. It includes descriptive statistics as well as an explanation and application of the econometric techniques used to estimate and analyse WTP. Finally, the fourth section provides a comprehensive analysis of money attitudes in this exemplary CVM survey. The analysis encompasses validity testing of the inventory used to measure Beijing citizens' money attitudes and scrutinising the distribution, the characteristics and the monetary habits of misers in the sample. Afterwards, the attitudinal variable is integrated into an econometric model used to assess the determinants of WTP statements. The question whether or not the presence of misers in CVM surveys threatens the validity of the overall WTP estimate is addressed in the fourth section. Consequences of discarding the potentially meaningless answers of misers from the sample, especially the effects of such data cleansing in terms of the sample's representativeness and average WTP, are demonstrated at the end of the section. The chapter closes with a discussion of the implications of the money attitude assessment and gives a number of recommendations regarding the analysis and treatment of money attitudes in CVM surveys. Chapter 6 concludes with a summary of the key findings and points to their relevance for future environmental valuation studies.

2 The economic valuation of environmental goods

2.1 Environmental valuation: why, what and how?

Economic valuation of environmental goods (environmental valuation in short) aims to put monetary values on natural resources, ecosystem services, biodiversity, the restoration or protection of ecosystems and other aspects of the natural environment. On the one hand, major international organisations like the World Bank or the OECD regularly apply environmental valuation techniques to monetise the costs or benefits of environmental goods (see Nunes, 2002: 46). On the other hand, some people argue that putting a price on nature is inappropriate or unethical. Those people cannot understand economists' motivation for doing so. Hence, one might wonder what environmental valuation is actually good for. In the following, the main purposes for environmental valuation will be identified (section 2.1.1). Afterwards, the economic concept of environmental values will be considered in more detail (section 2.1.2). Finally, several environmental valuation techniques will be introduced and discussed (section 2.1.3).

2.1.1 Motivation for environmental valuation

The natural environment favours people's life in many ways. Most importantly, it provides life support systems like air, water and food which are essential for the existence of human life (see Tietenberg, 2007: 13). In addition, the natural environment provides the economy with raw material, minerals and energy which can be used for the production of consumption goods. Natural ecosystems also play an important role in climate regulation and the purification of water and air; rain forests, for example, provide such regulating ecosystem services. Enjoying a beautiful sunset, watching wildlife or being happy about the pure existence of certain plant or animal species can be added to the list of examples which illustrate the benefits of the natural environment for society. The various benefits of the natural environmental will be termed **environmental goods** in the present study.

Most environmental goods have public good characteristics, meaning that nobody can be excluded from using them and, in the case of a few environmental goods, consumption is non-rival. An example for an environmental good which shares the characteristics of non-excludability and non-rivalry is fresh air. Everybody can breathe fresh air without hindering others to breathe it. Furthermore, nobody can be excluded from breathing fresh air by legal means. While non-excludability also applies to most other environmental goods, non-rivalry is the exception. For instance, nobody can be excluded from swimming in a public bathing lake (non-excludability) but swimming becomes less enjoyable in a crowed lake (rival consumption). Public lakes, rivers, natural parks, fishery, land for hunting or grazing and many other environmental goods fall into the category of so-called amenities, i.e. non-excludable but rival environmental goods.

Private markets typically fail when it comes to the provision, protection or restoration of environmental goods. This is because non-excludability implies that rational individuals do not pay a

price for the benefit they gain from consuming environmental goods. Economic theory postulates that rational individuals will take the position of free-riders, meaning that they consume environmental goods but refuse to bear the costs of their provision, protection or restoration. Taking the fresh air example again, rational individuals will not contribute personally to the improvement of air quality as long as other members of society are likely to exploit their efforts by enjoying improved air quality without reducing their polluting activities. As a consequence, environmental goods are not or not efficiently allocated by the market and require government activity. In particular, governmental intervention is indispensable in the case of environmental amenities which risk being overused or to be fully depleted. Governments can reduce this risk, for example by restricting the access to environmental goods or by taxing their exploitation. Hence, government intervention is needed in order to prevent an underprovision of environmental goods.

Besides the theoretical justification of government activity in the environmental sector, environmental awareness has risen over the last decades in many countries and there is an increasing pressure to account for environmental impacts in decision-making (cf. Bennett, 2011). Therefore, it is in the best interest of governments to bring forward environmental projects, i.e. measures which lead to environmental improvements. Public resources for funding environmental projects are, of course, limited. Spending public funds on an environmental project means that these resources cannot be spent for any other purpose. Therefore, government representatives have to judge the desirability of every major environmental project and make choices concerning the allocation of the available budget among alternative projects. Government representatives should justify their decisions by assessing the effects of a particular project on society's wellbeing. This is generally done by comparing the gains (benefits) and losses (costs) of all members of a society who are affected by a particular project or policy. A practical standard for approving projects and policies is that a policy measure's benefit should exceed its costs (cf. Atkinson and Mourato, 2008). Moreover, government representatives should opt for those projects or policies with the highest benefit-cost ratio (see Nunes and Schokkaert, 2003: 47).

Obviously, a precondition for a project assessment by means of cost-benefit analysis is that the project's costs and benefits are measurable and can be compared to each other. While the estimation of the costs incurred when implementing and monitoring an environmental project is relatively straightforward, the assessment of the benefits of such a project is by far more complicated. Since environmental goods with public good characteristics are typically not traded in markets the value of environmental improvements cannot be simply derived from market prices. Here, environmental valuation comes in: Based on particular non-market valuation approaches, environmental valuation studies provide monetary values for environmental goods. Hence, environmental valuation plays a key role for **cost-benefit analysis** of projects or policy proposals which directly aim to enhance environmental quality (cf. Bateman et al., 2002). Moreover, environmental valuation is also needed for a comprehensive project assessment in others than the environmental sector. Projects in the transport sector, for example, often affect the state of the

neighbouring environment. The construction of a new highway typically goes along with environmental damage such as the destruction of habitat or higher levels or air pollution. Investments into public transport, by contrast, often enhance environmental quality due to a reduction of traffic fumes. Hence, not accounting for environmental impacts would lead to a wrong project appraisal.

In addition to its essential role in providing monetary values to cost-benefit analysis, environmental valuation also serves to calculate welfare indicators which account for the state of the environment of a country, like the **green gross domestic product** (GDP). In its standard form, the GDP only accounts for the production of goods and services in an economy in a given interval in time. Since industrial production often goes along with environmental deterioration the classical GDP is likely to overestimate the actual welfare of a country. The green GDP is an extension of the classical measure because it accounts for the change of the natural capital stock in addition to the conventional estimate of national income (cf. Ahlheim, 2003). The monetisation of the cost of environmental degradation and of negative externalities such as pollution is of central importance in the calculation of the green GDP (see Nunes and Schokkaert, 2003: 48).

Another purpose of environmental valuation is the **assessment of environmental damage costs** caused by industrial accidents such as oil spills, nuclear disasters and other accidental pollutions. In the U.S. environmental valuation studies are conducted frequently subsequent to industrial accidents. This is because U.S. states and individuals can claim compensation payments for environmental damage. The monetary value estimates derived from damage assessment studies build a legal basis for claims for monetary compensation in liability cases. In Europe, environmental damage assessment has not become an issue yet because legal arrangements are different than in the U.S. (ibid.).

Finally, environmental valuation is sometimes used to **calculate environmental tax rates** or to simply **demonstrate the environmental consequences** of certain activities (see Bateman et al., 2002: 15). An example for such demonstrative studies is the ExternE initiative, which was a project series funded by the European Commission aimed to explore suitable approaches to assess the social cost of energy production (see e.g. ExternE, 2005). Hence, environmental valuation is applied in several diverse areas. However, its application in the context of cost-benefit analysis of public investment projects remains one of the most important uses (see Freeman et al., 2014: 3). To get a deeper understanding of the welfare economic background of environmental cost-benefit assessments, the welfare-criterion underlying this approach as well as the economic concept of environmental values will be introduced in the next section.

2.1.2 Economic concepts: welfare criteria and environmental values

Assessing the desirability of the realisation of certain policies is a key aspect of applied welfare economics (see Mitchell and Carson, 1989: 18). From the welfare economic perspective, a policy is desirable if it enhances the wellbeing of society. By definition, the wellbeing of society depends on the welfare of all its individual members and is formally given by a social welfare function, e.g.

$$W = w(U_1, U_2, \dots, U_h), \frac{\partial w}{\partial U_h} > 0; (h = 1,2, \dots, H), \quad (2\text{-}1)$$

where U_h is the utility level of all individual households h making up a society of H members. Hence, the utility changes of all individuals affected by a certain policy need to be considered in order to judge the desirability of this policy. Although this concept seems to be very obvious at first glance, determining the direction of the change in social welfare, i.e. answering the question whether or not society is better off after a certain policy change has happened, has bothered economists for centuries (see Bockstael and McConnell, 2007: 12).

In welfare economics, judgements concerning the desirability of a certain policy or project are based on so-called welfare criteria. The standard welfare criterion is the **Pareto criterion**. It states that a policy or project is desirable if and only if it makes at least one person better off while making nobody worse off than in the initial situation. Hence, a policy or project is beneficial for society if and only if there are no losers. In practise, however, there are hardly any policy changes which make nobody worse off; most government programmes or projects improve the wellbeing of some people but affect the wellbeing of others in negative ways. Thus, the strict Pareto criterion is seldom helpful for practical project assessments. A weaker and at the same time more practicable welfare criterion is the compensation principle proposed by Hicks (1939) and Kaldor (1939). According to the **Hicks-Kaldor compensation principle**, a policy or project is desirable if those who gain from this policy or project could potentially compensate those who lose. The Pareto criterion would be met if the winners indeed compensated the losers (see Mitchell and Carson, 1989: 21). However, the Hicks-Kaldor compensation principle does not require that the compensation is actually paid. The criterion has therefore also become known as the 'potential Pareto criterion' or the 'potential compensation test'.

The assessment of environmental projects by means of cost-benefit analysis operationalises the potential Pareto criterion by checking whether the gains outweigh the losses experienced by those members of a society who are affected by the project in question. If this is the case, the winners could potentially compensate the losers, indicating that the policy change is desirable from society's perspective. Benefit-cost considerations require that the gains and losses are expressed in terms of the same units, in other words, the economic value of gains and losses must be monetised. At an individual basis, the value of a good equals the maximum amount of money an individual is willing to give up in exchange for the good out of his or her budget, i.e. an individual's WTP (see Mitchell and Carson, 1989: 21). The value of a good for society, i.e. its social value, is thus some aggregate of individual values, for example the sum of individual WTP figures.

A consequence of this welfare economic conceptualisation of the social value of environmental improvements is that the worth of an environmental good is exclusively determined by the utility humans gain from this good. The importance of environmental goods for non-human species is not taken into account when assigning economic values to environmental goods, at least not directly. As a consequence, all what matters when assessing the desirability of an environ-

mental project is determining the direction of the change in social welfare it causes – nature has no value on its own within the economic framework. The purely anthropocentric procedure to determine the value of environmental goods used in economics can be opposed to the approach to assign 'intrinsic values' to nature, which is sometimes propagated by philosophers or ecologists. An intrinsic value is a value which is independent of human interests (see Tietenberg, 2007: 18). Intrinsic values can thus be ascribed to all kinds of things, including environmental resources, independently from their usefulness in satisfying human wants. Hence, from this alternative perspective on environmental values, the question how much benefit society gets from a particular environmental improvement does not matter when assigning a value to an environmental good.

It is to be noted that the idea that the value of nature consists of more than just its direct usefulness for humans is quite consistent with the concept of environmental values that many contemporary economists employ. As pointed out by Weisbrod (1964) and Krutilla (1967), the utility of an environmental good is not exclusively related to people's active consumption of that good; it can also result singularly from a person's knowledge about the existence of a particular species, landscape or any other environmental good or from having the option of using an environmental good in the future. This idea inspired the development of the concept of the so-called **total economic value** (TEV) conferred by natural resources. The TEV encompasses the use value (UV) and the non-use value (NUV) of an environmental good (cf. Bateman et al., 2002). The use value refers to the benefit people gain from directly using/consuming the good (see Nunes, 2002: 4). For example, a particular river clean-up project benefits all those who use this river as a source of drinking water or for recreational purpose (swimming, fishing, taking a walk along the riverside, etc.). The non-use value embraces any value people attach to the environmental good without using it actively. Researchers often break the non-use value down into several subcategories, such as the option value, altruistic value, bequest value and existence value (cf. Ahlheim et al., 2013b). The **option value** (OV) refers to the satisfaction people gain from knowing that they have the possibility to use the environmental good some day in the future. Taking the river clean-up project again as an example, even if a person does not actively use the river for recreation purpose or as a source of drinking water, he or she may still be happy to have the option to enjoy the benefits of clean river water. **Altruistic values** (AV) arise when an individual believes that the environmental good should be available for his or her fellow citizens. People who are concerned that future generations should have the possibility to enjoy the environmental good will attribute **bequest value** (BV) to the protection or improvement of environmental goods. For instance, irrespective of whether a person uses the river actively or not, he or she may be happy that his or her fellow citizens (AV) and/or future generations (BV) can drink clean river water or use the river for recreational purpose. Finally, the **existence value** (XV) refers to simply knowing about the protection of an environmental good. Some people may appreciate the environmental impacts of the exemplary river clean-up project for its own sake, independent of any active or optional use and the benefit of the river for others. Taken together, the TEV corresponds to:

$$TEV = UV + NUV = UV + (OV + AV + BV + XV)^1$$

The inclusion of non-use benefits into the economic concept of value has a number of consequences for environmental valuation studies. First of all, accounting for non-use values often increases the scope (and cost) of an environmental valuation study. Since the social benefit of an environmental project refers to the increase in wellbeing of all individuals *affected* by the environmental improvement, a researcher needs to know who is actually affected, before implementing an environmental valuation study. The definition of the members of the population who are affected, however, is not straightforward if non-use values of an environmental project are taken into account. Most environmental valuation studies are conducted at the place where the environmental project in question shall be realised. Local people are typically considered as being affected by the environmental project since the wellbeing of these people is likely to increase most noticeably through the environmental improvement. However, in addition to the local population, other people may also benefit from the environmental improvement in question. By definition, non-use values can be experienced without active usage of a good. Therefore, the potential beneficiaries of an environmental project may live at any distance from the project site, in a neighbouring country or even on another continent. As argued by Ahlheim et al. (2013b) environmental evaluation studies which exclusively focus on the benefits of the local population risk to produce an underestimate of the true social value of the project of interest and may thus cause wrong project appraisals. At the same time, assessing the benefits of a greater number of people (e.g. a country's entire population) is more complex and usually more costly than just focussing on the local population, especially when survey techniques are used to determine the value of an environmental project.

Secondly, the concept of the TEV has consequences for the choice of the environmental valuation technique to be applied. Ideally, the social value estimate of an environmental project should capture both use and non-use values. In many cases, non-use values make up a major part of the benefits accruing from the protection or preservation of a particular environmental good. Ignoring such values would lead to a dramatic underestimation of the true benefits of many environmental projects (see Nunes, 2002: 7). However, as the next section will show, not all environmental valuation techniques account for both use and non-use values. Unfortunately, those methods which do allow for a comprehensive assessment of the TEV of environmental goods are at the same time the most time-intensive, costly and criticised ones. In the next section the most commonly used environmental valuation techniques will be reviewed and discussed with respect to their capacity of accurately estimating the social value of environmental projects.

[1] It is to be noted that there is no standardised way of classifying the different value components of the TEV. Bateman (2002: 28), for example, puts the option value into the category of use value since 'use values relate to actual use of the good in question (…) or planned use'. Nunes (2002) also assigns the option value to the group of use values but does not explicitly mention the altruistic value as a component of the TEV. Tietenberg (2007), in turn, resigns from breaking down the non-use value into subcategories but opens a separate category for the option value, presumably because future use is possible but not certain so that the option value cannot unambiguously be classified as use or non-use value.

2.1.3 Environmental valuation techniques

There are two main approaches to place monetary values on environmental goods: stated and revealed preference methods. Stated preference techniques rely on surveys which are used to elicit people's preferences for changes in the quantity or quality of a particular environmental good. Survey participants are asked to *state* their preferences for the environmental good, for example to express their WTP for a particular environmental project. Revealed preference techniques are based on information on consumers' past behaviour on markets which are unambiguously related to the environmental good in question (see Bennett, 2011: 3). The choices consumers have made in these related markets, for example the prices they paid or the costs they incurred to visit an environmental site, *reveal* their preferences for the same environmental good. In contrast to stated preference techniques, which rely on hypothetical answers to hypothetical questions, revealed preference techniques draw inference from actual choices. Given that revealed preference techniques use seemingly more objective data than stated preference techniques, they also enjoy the status of providing more accurate environmental values. However, as argued in the following paragraphs, revealed preference techniques risk underestimating the TEV of environmental goods.

In the context of environmental valuation the travel cost method and the hedonic price method are the most frequently used revealed preference methods (cf. Atkinson and Mourato, 2008). The **travel cost method** (TCM, cf. Haab and McConnell, 2002, chapter 6 for a comprehensive overview) is frequently applied to assess the monetary value of recreational sites, such as public parks, conservation areas or beaches. The principal idea underlying this methodology is that the trip costs people bear when visiting a particular recreational site reveal the value they attribute to this environmental good. Trip costs include transit costs, equipment cost, entrance fees as well as time cost and vary across visitors. People living at immediate distance of a recreational site obviously face lower trip costs than people living far away. Accordingly, locals typically take a higher number of trips than people who have to travel long distances. TCM practitioners make use of the relationship between visit frequency and trip cost by constructing demand functions that relate these two variables to each other (cf. Parson, 2003). These demand functions can then be used to assess the benefits accruing to the visitors of an environmental site. Depending on the complexity of the travel cost model, the method requires more or less comprehensive data. In its simplest variant, TCM uses only information about the number of visitors from different regions. Such data can be easily gathered, for example by asking the visitors about their postal code when entering the recreational site. More sophisticated travel cost models require more detailed data which is usually obtained from extensive surveys conducted with the visitors of an environmental site (for a detailed overview of different travel cost models and a recent example of a survey-based TCM application, see e.g. Riera et al., 2011).

The **hedonic price method** (HPM, cf. Bockstael and McConnell, 2007 for a detailed review) is an appealing option for assessing the benefits of environmental improvements that directly affect the price of some market commodity. For example, different levels of ambient air quality,

road noise or landscape beauty are likely to affect the price of houses. If two houses have mostly identical characteristics, say, the same size, the same number of rooms and windows, but differ in terms of the level of ambient air pollution in the area they are located, it can be expected that the two houses differ in prices – the one that is located in a region with clean air will sell at a higher price than the one located in a region where people suffer from severe air pollution. HPM aims to isolate the price component referring to such environmental attributes from the overall price of a house (cf. Brouwer et al., 2010). The so-called implicit price of an environmental attribute reflects homeowners' marginal WTP for this attribute and builds the basis for estimating the welfare effects of a change in the quality or quantity of this attribute. HPM uses data from sales of houses and building sites in a particular region within a certain period of time. Such data can be relatively easily obtained from property records (cf. Ahlheim and Frör, 2003).

In addition to the travel cost and hedonic pricing techniques, there are cost-based revealed preference methods which are occasionally used in the context of environmental valuation. The **averting behaviour method** (cf. McConnell and Rosado, 2000 for more details), for example, explores the costs of behavioural adjustments people make to environmental changes. Expenditures on goods which are consumed as substitutes for environmental goods are expected to change with the supply of environmental goods. For example, increased expenditures on bottled water are likely to reflect the social cost of poor tab water quality.

Revealed preference methods have in common that they observe actual choices people have made to use a particular environmental good to draw inference on the value of this good. This means that all kinds of benefits which are independent from active usage are not reflected in the value estimates obtained from these methods. However, as stressed in section 2.1.2, environmental goods often generate non-use values, which are, by definition, unrelated to active usage. Since revealed preference methods are so to speak 'blind' (Ahlheim and Frör, 2003: 360) for non-use values, they should not be applied whenever an environmental project or policy is likely to affect the welfare of more people than just the active users of the environmental good(s) to be provided. In addition to that, revealed preference methods are not suitable for the valuation of prospective environmental changes. This is because these methods rely on data of past behaviour. Accordingly, the value of environmental goods provided in the future, like opening a new natural reserve, cannot be assessed with the help of these techniques. Furthermore, revealed preference methods can be applied only to a limited number of environmental goods. While TCM is almost exclusively used to assess the value of recreational sites, applications of HPM are more diverse but studies assessing the value of air quality are most prominent. However, the applicability of HPM strongly depends on the location of the environmental good – ideally densely populated areas where property frequently changes owners – and the availability of comprehensive data from the local real estate market. In that sense, both methods are rather inflexible, i.e. they cannot be applied to any environmental good in any location. Taken together, the at first glance appealing idea of making inference from actual behaviour on real markets on environ-

mental values goes along with severe limitations. Some of these limitations can be overcome by employing stated preference methods.

Contingent Valuation[2] is the oldest and most frequently applied stated preference technique (see Atkinson and Mourato, 2008: 319). As can be inferred from its name, the value estimates that the CVM produces are *contingent* on a hypothetical market where a particular environmental good is traded. The hypothetical market scenario usually encompasses a description of the environmental good in question; the institution(s) responsible for its provision; and an explanation regarding the funding mechanism of the environmental good's provision (ibid.). Most CVM practitioners design the hypothetical market scenario as an environmental project to be financed by private households' contributions. Afterwards, they ask the respondents to state their WTP for this environmental project. Individual WTP statements are interpreted in terms of the utility increase a respondent would experience due to the resulting environmental improvement. Under certain circumstance – most notably, a survey that is representative for all individuals affected by the environmental change in question – the sample's average WTP provides a suitable basis for assessing the overall value of an environmental good.

During the last two decades choice modelling has become increasingly popular for assessing environmental values. Similar to HPM, choice modelling involves estimating attribute-specific values of a particular good. Like CVM, the method is survey-based and uses hypothetical markets to assess the value of non-market goods. In the environmental valuation context choice modelling is particularly attractive for the assessment of society's preferences for several characteristics of an environmental project. The most prominent variant of choice modelling are so-called **choice experiments** (cf. Hoyos, 2010 for a recent overview). Just as CVM interviews, choice experiments typically start with a detailed description of the environmental good of interest. After having learned more about a particular environmental problem, participants of a choice experiment are presented with a so-called choice set and asked to choose their most preferred alternative from this set. For example, a choice set may consist of the following three alternatives: a) a large scale renaturation project at a high cost per household in additional taxes; b) a low scale renaturation project at a low cost per household in additional taxes; and c) a baseline alternative corresponding to the current situation, i.e. no renaturation project and no additional cost. The alternative projects are defined by a number of attributes and the level of attributes differs across alternatives (c.f. Hoyos, 2010). To increase the amount of information obtained from a choice experiment, the choice task is usually repeated several times by presenting multiple programs which encompass different levels of the relevant attributes to the participants. Each time when confronted with a new choice set respondents have to make trade-offs between attribute levels and costs. By analysing these trade-offs the method yields estimates for the marginal rates of substitution between pairs of attributes (c.f. Freeman et al., 2014). Provided that a money measure (cost or price) is included as an attribute of the alternative programs, the marginal WTP

[2] A detailed overview can be found in the textbook by Mitchell and Carson's (1989) as the primary reference for contingent valuation studies. Furthermore, section 2.2 and section 2.3 of this chapter provide more details regarding the theoretical underpinning and the practical use of this method.

for each attribute can be assessed (c.f. Hoyos, 2010). Choice experiments are an appealing alternative to CVM surveys for the assessment of the social benefit accruing from an environmental project because they yield more information on people's preferences for several aspects of the project in question. Standard CVM surveys merely provide a monetary value for a specific environmental project. Such a single-shot value can also be estimated from a choice model but in addition to that, marginal WTP figures for each attribute of the project are obtained. From a policy maker's perspective, such attribute-specific values can be very informative, especially when having to decide on the scope of an environmental project or among different policy options. However, confronting the participants of a stated preference survey with a sequence of choice tasks, rather than with a single payment question, goes along with a number of difficulties. Most notably, respondents may lose interest or feel overburdened when repeatedly asked to select their preferred option out of a set of alternatives. This can have severe consequences for the validity of the results of choice experiments. For example, a number of studies found that respondents tend to ignore attributes when confronted repeatedly with similar choice tasks (c.f. e.g. DeShazo and Fermo, 2002, Carlsson et al., 2010). Furthermore, many respondents seem to use rules-of-thumb instead of making trade-offs among all attributes presented to them (cf. Freeman et al., 2014).

Contingent valuation and choice experiments are necessarily based on interview-administered or self-administered surveys. Accordingly, they are relatively costly environmental valuation approaches. Furthermore, both techniques suffer from similar methodological weaknesses, including all kinds of biases discussed in section 2.3.2. For example, WTP statements of stingy respondents are likely to distort the results of both CVM surveys and choice experiments. In the case of a CVM survey, misers can be expected to state a zero WTP when asked about the amount of money they would be willing to pay for the environmental project in question. Likewise, it must be anticipated that misers always choose the cheapest alternative from a choice set, i.e. the status quo option that implies no additional expenditure to them. As will be shown in more detail in chapter 5, the presence of stingy respondents in a stated preference survey poses problems if their choices are unrelated to the environmental improvement to be valued and simply reflect a strict decision rule like 'I don't want to spend money on anything'. Obviously, the presence of misers does not distort the results of revealed preference studies. Since revealed preference methods rely on the observation of actual spending decisions, the preferences of non-spenders are not represented in the corresponding datasets. Stingy people, the poor and all other individuals who do not spend money on the related market of concern fall into the category of non-users and hence the share of society whose preferences are neglected in revealed preference studies. However, in the same way as the dispositions of people to spend money in general can be expected to influence their answers in stated preference surveys, it is also plausible that people's attitudes towards spending affect their expenditures for visiting recreational sites, the amount of money they are willing to spend on housing, their expenditures for bottled water and hence the results of revealed preference studies. Accordingly, irrespective of the valuation technique used, environmental values may always reflect a society's money attitudes. However, only stated pref-

erence techniques risk to yield biased value estimates because they account for the presumably meaningless WTP statements of misers.

Despites their comparatively higher cost and vulnerability to bias, stated preference methods have several advantages over revealed preference methods. Compared to the latter group of methods, stated preference methods are more flexible environmental valuation tools (c.f. Carson and Hanemann, 2005). Stated preference surveys are suitable for the assessment of the monetary value of virtually any environmental change occurring in any region, at any time. For example, the value of environmental improvements in remote regions which are hardly visited by tourists and scarcely populated can be relatively easily assessed in surveys. TCM or HPM are not suitable for such cases due to the absence of tourists and sufficiently large housing markets. Moreover, stated preference data is not necessarily limited to a particular group of people within the overall population (e.g. tourists in the case of TCM or house owners in the case of HPM). Researchers can organise the CVM survey in a way so that the value estimate reflects the preferences of all kinds of people potentially affected by an environmental change. Most importantly, stated preference methods do not rely on past utilisation behaviour. Therefore, social value estimates are expected to capture the whole TEV, i.e. both use and non-use values. In spite of persisting debates concerning the reliability and validity of stated preference methods (cf. section 2.3.2), CVM and choice experiments are of great practical importance in the policy context. This holds especially true for the U.S. where the National Oceanic and Atmospheric Administration (NOAA) advises explicitly including non-use values in environmental damage assessments (c.f. Arrow and Solow, 1993).

In sum, inferring monetary values for environmental goods from hypothetical answers to hypothetical questions is still controversial. However, revealed preference techniques represent no alternative to stated preference methods in many circumstances, especially when individuals are likely to place value on an environmental good they do not actively use (c.f. Freeman et al., 2014). The two stated preference techniques considered here, CVM on the one hand and choice experiments on the other, have in common that they provide monetary measures of the total economic value of an environmental good, accounting for both use and non-use values. Each method has strengths and weaknesses, but it is hard to say whether the traditional CVM or the more recently developed choice modelling approach perform better in providing coherent monetary values for environmental goods. Given the comparatively longer tradition of using CVM surveys to assess environmental values and the huge amount of research aimed at improving this methodology, opting for CVM may be the safest choice for the assessment of the social benefits of a complete environmental project. However, if an analyst is interested in the values individuals place on certain characteristics of an environmental project, the choice experiment is the more suitable option. The empirical part of this dissertation relies on an extensive CVM survey which was implemented to assess the preferences of Beijing's urban population for an environmental restoration project in Northwest China. Hence, the theoretical underpinnings of this particular

method as well as issues related to the practical implementation of a CVM survey will be addressed in the following sections.

2.2 Theoretical underpinning of the Contingent Valuation Method

In the environmental valuation context, contingent valuation surveys are used to obtain correct estimates of the benefits of environmental projects (c.f. Mitchell and Carson, 1989). Such figures can then be used in a cost-benefit analyse to determine the impact of a change in environmental quality on society's welfare. Environmental projects typically have a number of effects which affect the wellbeing of at least some, if not all households in a society. A river clean-up project, for example, leads to improved environmental conditions at the project sites. In addition to that, people living at any distance of the river may enjoy the benefits of the clean-up projects which are unrelated to direct use, such as its value for future generations. Furthermore, if existing public funds are insufficient to finance such a project and the government has to collect additional money from households, individuals will suffer a decrease in their income levels. Due to enhanced environmental quality on the one hand and reduced income levels on the other, households' consumption habits may also change. For example, the demand for swimming suites may increase while the demand for bottled water might decrease subsequent to the realisation of a river clean-up project. Changes in the demand for market goods, in return, have effects on relative prices. Hence, environmental projects typically affect society's wellbeing through different channels, namely direct environmental effects as well as indirect effects on income and market prices (cf. Ahlheim, 2003). In order to know whether or not society is better off after the implementation of an environmental project, all these potential effects should be taken into account when assessing the benefits of an environmental project. What is needed for an accurate project assessment is an indicator which unambiguously indicates the direction of the welfare change induced by an environmental project.

Since social welfare is defined in terms of the utility of individual households (cf. equation 2-1 in section 2.1.2), the assessment of a welfare change can be broken down into two steps. The first step consists of determining individual utility changes; the second step comprises the aggregation of these individual utility changes in order to obtain an indicator of social welfare (ibid.). The next section focuses on the first step, namely on the identification of individual welfare change.

2.2.1 Identification of individual welfare change

As explained in section 2.1.3, the objective of CVM surveys and other environmental valuation techniques is the assessment of people's WTP for environmental goods. The concept of WTP is derived from theoretical measures of welfare change. The traditional welfare measure identified in literature is the consumer surplus, first proposed by Dupuit ([1844] 1995) and developed more fully by Marshall (1989) in the 19th century. Changes of the consumer surplus due to, for example, a price change, are commonly interpreted as money measures of utility changes. However,

measuring welfare changes based on this concept has a number of drawbacks. Most importantly, in cases of multiple price changes or when prices and income change simultaneously, the change of consumer surplus is affected by the order in which the changes of the different variables are considered. In addition to that, the consumer surplus serves as a meaningful measure of utility change only based on very stringent, extremely unrealistic assumptions (for a detailed illustration see e.g. Ahlheim, 1998b: 495-501, Just et al., 1982: 73-83).

In view of the shortcomings of the traditional welfare measure, Hicks (1943) suggested four alternative measures of welfare change. Two of these measures, the equivalent variation (EV) and compensating variation (CV), apply to situations where an individual is free in adjusting its consumption choices subsequent to a price or quantity change of a particular good. Hicks (1943) described two additional measures, the equivalent surplus (ES) and the compensating surplus (CS), which are suitable in cases where individuals cannot freely adapt their consumption choices when the economic environment changes but have to consume imposed quantities of a good (c.f. Just et al., 1982). The two Hicksian surplus measures are frequently applied to measure the welfare effects of policies or projects which lead to changes in the provision of public goods and which leave prices unaffected (c.f. Freeman et al., 2014). However, ES and CS are not suitable for the evaluation of policies and projects that can be expected to cause price changes. This is because in market economies individuals are free to adjust their consumption, for example to consume less of a particular good subsequent to an increase in its price. In other words, they are able to adapt their consumption choices (c.f. Just et al., 1982).

Having two kinds of Hicksian welfare measures at choice, variation measures and surplus measures, the question arises which one is most suitable for the evaluation of environmental projects. On the one hand, many environmental goods are, like public goods, available at fixed quantities only. The fact that households cannot simply adjust their consumption of, for example, clean air but have to take the quantity or quality of environmental goods as given calls for the use of one of the two surplus measures when assessing the welfare effects of an environmental project. Several authors, including pioneering economists in the field of environmental valuation like Mitchell and Carson (1989) and Freeman et al. (2014), recur to ES and CS to assess the welfare impacts of environmental policy proposals. On the other hand, for the conduct of a comprehensive cost-benefit assessment of an environmental project, not only the environmental consequences but also all kinds of indirect effects, especially price and income effects should be taken into account (cf. Stephan and Ahlheim, 1996). Hence, EV and CV appear to be more adequate choices than the two surplus measures to evaluate the welfare effects of environmental projects with direct and indirect effects. The focus of this section therefore lies on the theoretical development of EV and CV as exact measures for the welfare effects of environmental projects. The remainder of this section closely follows the illustrations in Stephan and Ahlheim (1996) and Ahlheim (2003).

The theoretical derivation of individual welfare measures for environmental projects involves alternative ways of expressing the satisfaction a household gains from the consumption of differ-

ent goods, including market goods and environmental goods. The utility a household gains from the consumption of market goods and the state of the environment can be described by means of the traditional direct utility function $u_h(x_h, z)$. The direct utility function is monotonically increasing in market consumption, described by the vector x_h, and in the state of the environment, described by the vector z. The parameters encompassed by the vector z refer to public goods; this means that all households consume the same quantity of these goods, namely the quantities available in a particular situation k. Furthermore, the enjoyment of these public goods is free of charge. Given the prices p of market goods and their fixed income I, all households H will maximise their utility. The constrained utility maximisation problem of an individual household h can be expressed as

$$\text{max. } u(x_h, z) \text{ s.t. } I_h \leq px_h;\ z = z^k;\ (h = 1,2, \dots, H). \tag{2-2}$$

An alternative way of representing the constrained utility maximisation problem is based on the indirect utility function $\upsilon_h(p, z, I_h)$. The indirect utility function indicates the maximum utility level a household can attain, given a specified price level p, the state of the environment z^k and the household's income I_h. The indirect utility function is obtained by solving the utility maximisation problem displayed in equation 2-2. Doing so yields the Marshallian demand functions for all market goods (commonly denoted as $x^* = x(p, z^k, I_h)$). To derive the indirect utility function, the Marshallian demand functions have to be substituted into the direct utility function. Since the indirect utility function relates the maximum utility level a household can reach to the price level, the state of the environment and the household's income, its employment turns out to be particularly useful when discussing the effects of environmental projects with direct and indirect effects on society's wellbeing.

Finally, a third way of expressing the constrained utility maximisation problem is of importance for the following discussion. This third approach involves the expenditure function and the following associated expenditure minimisation problem:

$$\text{min. } p \cdot x_h \text{ s.t. } u(x_h, z) \geq U_h, \tag{2-3}$$

where U_h is an arbitrarily specified level of utility that the household can at least realise. Solving the expenditure minimisation problem yields the Hicksian-compensated demand functions (commonly denoted as $x^* = \xi_h(p, z^k, U)$). Plugging these functions into an expression referring to the household's total expenditure yields the expenditure function $e_h(p, z^k, U_h)$. The expenditure function gives the minimum expenditure the household needs to make in order to reach the specified utility level U_h, given the state of the environment z^k and prices p. The expenditure function is monotonically related to utility; it strictly increases with the utility level U_h. This is to say that the higher the utility level a household wishes to realise is, the more the household needs to spend. Because of this strict relationship between utility and expenditures in terms of money the expenditure function is commonly known as the 'money-metric utility function' (Samuelson, 1983), i.e. a function which measures utility in monetary units. Under the assumptions that households spend all their disposable income on market goods, the expenditure function equals a

household's income. In a world without time where individuals consider their income as nothing else than a means to purchase the goods and services they desire, this assumptions is quite plausible. In the real world, however, there are of course reasons why households refrain from depleting their entire income, including their need to save for future consumption or their desire to accumulate their financial resources. Even though the assumed equality between income and expenditures is not fully realistic, the representation of a household's utility by means of the expenditure function is appealing because income levels are, in contrast to utility, empirically observable.

A change in the wellbeing of a household induced by the implementation of an environmental project can thus be defined in different ways, depending on the kind of utility function employed. In general, the change in wellbeing, denoted by ΔU in the following illustrations, equals the difference between a household's utility level before and after a particular environmental project has been carried out. In the following equations, these two situations will be indicated by the superscript k, where k=0 describes the initial situation and k=1 the final situation. A first form of expressing the utility difference between the status quo and the new situation is (Ahlheim, 2003: 11):

$$\Delta U_h^{01} = U_h^1 - U_h^0 = u_h(x_h^1, z^1) - u_h(x_h^0, z^0); (h = 1,2, \dots, H). \quad (2\text{-}4)$$

U_h^0 indicates the utility level in the initial state, i.e. the situation before the project has been realised, and U_h^1 the utility level in the new situation, i.e. the situation after the implementation of the project. Alternatively, the change in utility of an individual household can be expressed via the indirect utility function:

$$\Delta U_h^{01} \equiv v_h(p^1, z^1, I_h^1) - v_h(p^0, z^0, I_h^0); (h = 1,2, \dots, H). \quad (2\text{-}5)$$

Equation 2-5 is a more evident way of representing the utility change induced by an environmental project because it reflects the three different channels through which the implementation of an environmental project may affect individual utility, namely changes in environmental quality ($z^0 \rightarrow z^1$), changes in income ($I^0 \rightarrow I^1$) and changes in prices ($p^0 \rightarrow p^1$). However, since neither the direct nor the indirect utility function can be observed empirically, further modifications are required in order to define a practically useful, i.e. empirically observable, welfare measure.

For this purpose, economists employ the concept of the expenditure function. As mentioned above, the expenditure function indicates a household's minimum expenditure on market goods to reach a specified utility level U_h, given prices p and the state of the environment z. If p and z are set constant, a change in utility can only result from a change in expenditure on market goods. To make use of this relationship between utility and expenditures, prices and income must be fixed at some arbitrary level. Two possibilities lie at hand, namely fixing prices and income at the initial level k=0 or the new level k=1. Accordingly, the utility change induced by an environmental project can be expressed in two different ways (see Ahlheim, 2003: 12). Fixing p and z at the initial level k=0 gives the equivalent variation:

$$EV_h^{01} = e_h(p^0, z^0, U_h^1) - e_h(p^0, z^0, U_h^0) = e_h(p^0, z^0, U_h^1) - I_h^0. \quad (2\text{-}6)$$

Fixing p and z at the new level k=1 gives the compensating variation:

$$CV_h^{01} = e_h(p^1, z^1, U_h^1) - e_h(p^1, z^1, U_h^0) = I_h^1 - e_h(p^1, z^1, U_h^0). \quad (2\text{-}7)$$

The utility change resulting from an environmental project is now expressed as the difference between two money metric utility functions. As illustrated in equation 2-6 and 2-7, EV and CV measure the difference in (money) expenditure levels associated with two utility levels when the state of the environment and prices are kept constant. The EV, as displayed in equation 2-6, measures the difference between the fictitious minimum expenditure the household would have to make to reach the new utility level U^1, given initial prices and initial environmental quality, and the household's actual expenditure level, i.e. its income, in the initial situation. Analogously, as denoted in equation 2-7, the minimum expenditure required to attain the new utility level, given new prices and the new state of the environment, equals a household's income in the new situation. The second term in equation 2-7 corresponds to the fictive expenditure level that would bring the household back to its initial level of utility U^0, given new prices p^1 and new environmental quality z^1. Hence, the CV corresponds to the difference in a household's actual income in the new situation and the fictitious expenditure the household would have to make to attain its initial utility level, given the new state of the environmental and new prices.

EV and CV will take different signs, depending on whether an environmental project affects a household's utility positively or negatively. If the project has a positive effect on a household's utility, the expression $e_h(p^0, z^0, U_h^1) - I_h^0$, and hence the EV, is positive; this is because the fictive expenditure level would be higher than the household's actual income in the initial situation. On the contrary, the EV becomes negative in the case of a utility decrease. Regarding the CV, the difference $I_h^1 - e_h(p^1, z^1, U_h^0)$ is positive for a utility-increasing policy change; this is because the household's effective income in the new situation exceeds the fictitious expenditure level necessary to reach the initial utility level, given new prices and the new state of the environment. By contrast, the CV takes a negative sign in the case of a utility-decreasing policy change.

It is well-known that the Hicksian welfare measures can be interpreted in terms of willingness to pay (WTP) and willingness to accept (WTA). To facilitate the following discussion, the EV and the CV are plugged into the indirect utility function. In the case of the EV this yields the following expression:

$$v_h(p^0, z^0, I_h^0 + EV) = v_h(p^1, z^1, I_h^1). \quad (2\text{-}8)$$

The EV corresponds to the amount by which a household's initial income would have to be adjusted in order to make the household indifferent between not obtaining and obtaining a prospective policy change. As already highlighted, the EV will be positive in the case of a utility-increasing policy. Therefore, it corresponds to the amount of money by which the household's income would have to be increased to raise the household's utility to the same level as the policy

measure would have done. Hence, the EV can be interpreted as a household's willingness to accept compensation to forgo a utility-increasing policy, for example an environmental protection project. Since the EV will be negative in the case of a utility-decreasing policy change, it corresponds to the amount of money which could be subtracted from a household's income to decrease the household's utility level to the same extent as the policy change would have done. Thus, the EV corresponds to a household's willingness to pay to prevent the negative effects of a policy, for example its WTP to prevent the implementation of a measure that would cause environmental damage. In the environmental context, researchers commonly interpret the EV as a household's WTA to forgo an environmental improvement or as its WTP to prevent environmental damage (c.f. Ahlheim, 2003). Analogously, the CV can be interpreted in terms of WTP and WTA. Plugging the CV into the indirect utility function gives the following equality:

$$v_h(p^1, z^1, I_h^1 - CV) = v_h(p^0, z^0, I_h^0). \tag{2-9}$$

The CV describes the amount of money by which a household's income would have to be adjusted in order to bring the household back to its initial utility level, once the policy change in question has happened. Since the CV takes a positive sign in the case of a utility-increasing policy, it equals the amount of money that could be taken away from the household's income in return to the policy change, leaving the household as well off as in the initial situation. In the case of a utility-decreasing policy the CV is negative and corresponds to the amount of money that would have to be added to a household's income to compensate the household for the loss in utility caused by the policy measure. Hence, it is common practise to interpret the CV in terms of a household's WTP for an environmental improvement and its WTA compensation for environmental damage (ibid.).

Both welfare measures reliably indicate the direction of a specific utility change: EV and CV are positive if the environmental project leads to a utility increase; and they are negative if the environmental project induces a loss in utility. Hence, a researcher has the choice between employing or the one or the other theoretical welfare measure for the assessment of the direct and indirect effects of a particular environmental project on individual wellbeing. However, in practical applications the CV is often preferred to the EV. In CVM surveys, for example, the benefits of environmental projects are typically derived from WTP questions. WTA measures are rarely used because respondents have an incentive to exaggerate their demand for compensation when answering WTA-questions. Early CVM studies backed this argument by showing that WTA estimates are consistently higher than WTP values for the same amenity (c.f. Mitchell and Carson, 1989). Since the present work focuses on the valuation of the benefits of an environmental project by means of WTP survey questions, the following illustrations are limited to the CV.

It is to be noted that the welfare indicator which is assed in a stated preference survey is not exactly the CV as displayed in equation 2-7. This is because the formulation of the compensating variation involves the abstract term $e_h(p^1, z^1, U_h^0)$. This term refers to the expenditure necessary to reach the initial utility level, given new prices and the new state of the environment. The term is fully abstract and cannot be observed empirically. Hence, additional modifications need to be

made to obtain an empirically observable welfare measure. Since environmental projects affect a household's utility through different channels, the CV can be separated into different components reflecting the environmental change, the change in market prices and the change in income the project in question would cause, i.e. (Stephan and Ahlheim, 1996: 175)

$$CV_h^{01} = e_h(p^0, z^0, U_h^0) - e_h(p^1, z^0, U_h^0) + e_h(p^1, z^0, U_h^0) - e_h(p^1, z^1, U_h^0) + I_h^1 - I_h^0. \qquad (2\text{-}10)$$

The first two expressions in equation 2-10 refer to a change in market prices ($p^0 \rightarrow p^1$); the third and the fourth expression refer to the change in environmental quality ($z^0 \rightarrow z^1$); and the last two expressions describe the income change ($I^0 \rightarrow I^1$). Making use of this additive nature, the CV can be decomposed into three separate components (Ahlheim, 2003: 16):

$$CV_h^{01} = CVP_h^{01} + CVZ_h^{01} + CVI_h^{01}. \qquad (2\text{-}11)$$

The overall CV (CV_h^{01}) thus equals the sum of three sub-CVs which refer to the utility change caused by a change in prices (CVP_h^{01}), by a change in environmental quality (CVZ_h^{01}) and by a change in income (CVI_h^{01}). This implies that different valuation techniques can be applied to assess the sub-CVs empirically. For the purpose of empirical computation, equation 2-11 is further modified, leading to the following expression (ibid: 17):

$$CV_h^{01} = \int_{p^1}^{p^0} \xi_h(p, z^0, U_h^0)dp + \int_{z^0}^{z^1} \pi_h(p^1, z, U_h^0)dz + I_h^1 - I_h^0. \qquad (2\text{-}12)$$

In equation 2-12 the change in prices is expressed as the integral over the Hicksian demand functions $\xi_h(.)$ between old and new prices; the change in environmental quality is represented by the integral over the income compensated environmental shadow price function $\pi_h(.)$ between the initial and the new state of the environment; and the change in income corresponds to the difference in income levels before and after the realisation of the environmental project in question. The empirical computation of the income-specific CV is relatively simple if an environmental project's welfare effects are assessed subsequent to the project's implementation. In this case, the income change can be calculated based on census data. Naturally, things become more complicated when an assessment takes place before a project's implementation. In that case future income levels have to be forecasted. The computation of the change in prices is more challenging because the corresponding expression involves the Hicksian demand function. Since Hicksian demand functions are not empirically observable, economists have developed heuristic methods such as Vartia's (1983) algorithm to compute the welfare effects of changes in market prices. These techniques make use of observable Marshallian demand functions in order to compute the integral over Hicksian demand functions. Like the assessment of prospective income changes, the computation of the price effect is more complicated when the project has not been implemented yet. This is because the new price level and hence the Marshallian demand functions are unknown in such a situation. Finally, the estimation of the compensating variation of a change in the state of the environment represents the greatest challenge. Neither the difference in expenditure levels reflected by CVZ_h^{01}, nor the integral over the income compensated environmental shadow price function between the initial and the new state of the environment are observable.

Heuristic methods such as Vartia's (1983) algorithm cannot be employed because the shadow prices of environmental goods are unknown and cannot be immediately deduced from observed market behaviour. Hence, more direct assessment techniques, such as the Contingent Valuation Method, have to be employed to assess the compensating variation of a change in environmental quality. Before turning to these practical aspects, the second step in the assessment of the welfare impacts of an environmental project shall be briefly addressed.

2.2.2 Aggregation of individual welfare changes

The WTP of a single household for an environmental project is little informative for decision makers who are interested in the welfare effects of their activities for society as a whole. Therefore, once the individual compensating variations have been assessed for all households affected by an environmental project, they have to be aggregated in order to obtain a monetary measure for the overall benefit of the project under consideration. To decide whether a project is beneficial for society, the Hicks-Kaldor decision criterion is typically employed. As explained in section 2.1.2, this criterion requires that the winners of a project could potentially compensate the losers without being worse off than without the project. Expressed in terms of CV, this decision criterion can be formulated as follows (Ahlheim, 2003: 22):

$$\sum_{h=1}^{H} CV_h^{01} \begin{matrix} > \\ = \\ < \end{matrix} 0 \Rightarrow \Delta W \begin{matrix} > \\ = \\ < \end{matrix} 0. \qquad (2\text{-}13)$$

The decision criterion postulates that if aggregate CV is positive (negative), social welfare increases (decreases). In equation 2-13 aggregate CV equals the sum of individual CVs, i.e. the sum of all WTP figures of those households benefitting from the project and the WTA of all households suffering utility losses due to the project. According to the standard interpretation, a positive sum of individual CVs indicates that the project is beneficial from a social point of view, while a negative sum indicates the opposite.[3]

As illustrated in the previous section, the overall compensating variation (CV_h^{01}) can be decomposed into income, price and environmental changes. Furthermore, these three components can be expressed as the difference in income levels between the new and the old situation, the integral over the Hicksian demand functions between new and old prices and the integral over the income-compensated shadow price function between the new and the old state of the environment (cf. equation 2-12). Hence, the exact computation of the social value of an environmental project requires that income, price and environmental effects are known for the entire population under consideration. Assessment of this data would be extremely time-consuming and costly. The determination of price effects, for example, involves complex and data-intensive pro-

[3] It should be kept in mind that this decision criterion is not compatible with ordinal utility theory because it implies that utility intensity can be measured and compared across individuals. This 'aggregation problem' has been covered extensively in literature, for instance by Johansson (1994), and will not be further addressed in the present work. Furthermore, the aggregation procedure may follow different rules than the simple one described here. For example, decision makers may wish to assign welfare weights to the WTP of certain groups of society instead of simply summing up the individual WTP measures.

cedures in order to estimate the demand systems for all households. Therefore, analysts often apply a simplified and less costly approach in practical environmental valuation studies. This simplification is based on a linear approximation of the exact version of the CV, displayed in equation 2-12 (see Stephan and Ahlheim, 1996: 176-179 for a detailed illustration). This simplification yields the following expression:

$$CV_h^{01} \approx -\nabla_p e_h(p^0, z^0, U_h^0)[p^1 - p^0] - \nabla_z e_h(p^0, z^0, U_h^0)[z^1 - z^0] + I_h^1 - I_h^0, \tag{2-14}$$

where $\nabla_p e_h(p^0, z^0, U_h^0)$ and $\nabla_z e_h(p^0, z^0, U_h^0)$ are the Hessian matrices of the corresponding expenditure functions. Because of the relationship between expenditures functions and Hicksian demand functions as given by Shepard's Lemma[4], expression 2-14 can be further simplified. This yields the following approximation:

$$CV_h^{01} \approx p^1 \cdot [x_h^1 - x_h^0] + \pi_h^0 \cdot [z^1 - z^0], \tag{2-15}$$

where π_h^0 is a vector of shadow prices the household assigns to the different environmental parameters encompassed by the vector z. The expression $p^1 \cdot [x_h^1 - x_h^0]$ now represents price and income effects. In the exact version of the total compensating variation (cf. equation 2-10 and 2-11) these two effects are measured by the sub-CVs for prices (CVP_h^{01}) and income (CVI_h^{01}).

In addition to this simplification, practical cost-benefit assessments are based on the assumption that environmental projects are financed out of scare economic resources. This means that if the environmental project in question was not implemented, these resources would be used for the production of market goods. As a consequence, prices will increase subsequent to the implementation of an environmental project. This price increase, in return, will lead to a reduction of the demand for market goods. Hence, the sum of the simplified price and income effects represents the overall cost of the environmental project to society. Practitioners approximate these social costs by the input costs related to an environmental project (wages, material, etc.). This gives the traditional benefit-cost expression

$$BC^{01} \approx \sum_{h=1}^{H} \pi_h^0 \cdot [z^1 - z^0] - q^1 \cdot y^1 \approx \sum_{h=1}^{H} CVZ_h^{01} - q^1 \cdot y^1, \tag{2-16}$$

where q is a vector of input prices and y a vector of input quantities needed in order to realise the project. According to the standard interpretation, a positive benefit-cost result indicates that a project should be implemented, while a negative result indicates the opposite. Naturally, the simplification of the exact variant of the CV goes along with a loss in precision. For example, the indirect effects of an environmental project on a household's utility, namely price and income effects which can affect a household's demand for market goods, are not captured by the simplified cost-benefit expression (c.f. Stephan and Ahlheim, 1996). However, the benefit-cost expres-

[4] Shephard's Lemma for market goods (a) and environmental goods (b) corresponds to (cf. Ahlheim 1998 for more details)

(a) $\frac{\partial e}{\partial p_n}(p, z, U) \equiv \xi_n(p, z, U) = x_n; (n = 1,2, \dots, N)$

(b) $\frac{\partial e}{\partial z_l}(p, z, U) \equiv -\pi_1(p, z, U) = -\pi; (l = 1,2, \dots, L)$

sion makes the assessment of the welfare effect of an environmental project much easier. Since the estimation of input costs is rather simple, the only remaining challenge consists of assessing the effect of the environmental change accruing from an environmental project on society's wellbeing. As highlighted in the previous section, CVZ_h^{01} is usually interpreted as the WTP of an individual household affected by the environmental project in question. Since this WTP is not directly observable from market data, revealed or stated preference techniques have to be employed for its estimation. The overall benefit of an environmental project (social benefit, B^{social}) is then approximated by multiplying the average WTP of a representative sample by the number of all households affected by this project, i.e..

$$\overline{B^{social}} = H \cdot \overline{WTP^{sample}} \,. \tag{2-17}$$

This figure is then compared to the social costs of the same project (C^{social}) in order to derive the net benefit accruing from the project:

$$\overline{B^{net}} = \overline{B^{social}} - \overline{C^{social}} \,. \tag{2-18}$$

As highlighted by Ahlheim et al. (2010b), the net benefit (B^{net}) is a good proxy for the sum of individual CVs displayed in equation 2-13. Hence, if the net benefit turns out to be positive, the environmental project is desirable from society's point of view. By contrast, the environmental project should not be implemented if its net benefit is negative. Obviously, the computation of the net benefit of an environmental project makes only sense if both benefits and costs are expressed in the same units. Since the social costs of an environmental project constitute the sum of all kinds of public expenditures related to the implementation of this project as well as forgone profits, the cost component of the benefit-cost equation 2-18 is necessarily a monetary value. Accordingly, the social benefit must also be expressed in terms of money. To avoid burdensome processes of conversion, it has become common practise to monetise individual utility changes directly rather than assessing them in some alternative unit first and to convert them into monetary units afterwards. The most prominent possibility of monetising individual benefits of improved environmental conditions consists of implementing a comprehensive CVM survey that asks a representative sample of households how much money they are willing to give up in exchange of the environmental improvement of concern. The next section focuses on the multiple challenges related to this undertaking.

2.3 The Contingent Valuation Method in practise

As highlighted in section 2.1.3, contingent valuation is a suitable method for the appraisal of prospective environmental projects that are likely to generate both use and non-use values. The present section introduces this environmental valuation method in more detail. The first part focuses on the administration of CVM studies. Issues related to the questionnaire design and the implementation of CVM surveys will be addressed. In the second part, criteria for the validity and reliability of CVM welfare measures shall be introduced. As a survey-based method, CVM

is prone to a huge number of errors. The most prominent sources of error and bias, and ways to reduce them will be discussed.

2.3.1 Questionnaire design and survey administration

As shown in section 2.2.1, the compensating variation measures the utility increase a household would experience due to enhanced environmental quality. The CV is commonly interpreted in terms of the household's maximum willingness to pay to obtain better environmental quality. Hence, a CVM practitioner's objective is to assess people's maximum WTP for an environmental good as precisely as possible. This is typically done by directly asking survey participants about the value they place on a specified environmental project. This payment question, or, in more technical terms, value elicitation question is the central element of an extensive CVM interview conducted based on a standardised questionnaire. Besides the payment question CVM questionnaires contain several information components as well as auxiliary questions to gather information that a researcher can use for the analysis of the WTP statements. A CVM questionnaire usually consists of the following parts (cf. Carson and Hanemann, 2005: 898):

(1) an **introduction** briefly presenting the purpose of the survey and some warm-up questions to assess a respondent's background knowledge about the environmental good in question
(2) a comprehensive description of the environmental good and the public project or policy which would lead to an increased provision or efficient protection of the environmental good (the **project scenario**)
(3) an explanation of the **hypothetical market** for the environmental good, including a payment vehicle, payment rule and the implementation rule (the **payment scenario**)
(4) the **value elicitation question**
(5) **debriefing questions** to gain insights into the respondent's motivation for giving a particular answer to the value elicitation question
(6) **follow-up questions** concerning respondents' socio-demographic and socio-economic characteristics as well as attitudinal questions

Even though there are no 'golden rules' for designing a CVM study, the recommendations of the NOAA panel (Arrow and Solow, 1993) still serve as a key reference. The NOAA panel was constituted three years after the Exxon Valdez oil spill in Prince William Sound, Alaska, in 1989, to evaluate the reliability of CVM surveys. This reliability assessment built a response to Hausman's (1993) severe criticism of the damage assessment study conducted by Carson et al. (1992). The latter study made use of the CVM to estimate the environmental damage caused by the Exxon Valdez oil spill. It was the first time that a stated preference technique was used to determine the fine that the oil industry had to pay as compensation for the pollution of Alaska's coast and for having killed thousands of animals. Despite the complaints of the oil industry and sceptical economists, the NOAA panel, headed the two Nobel winners Kenneth Arrow and Rob-

ert Solow, concluded that the CVM was a reliable environmental valuation technique. Furthermore, they published a number of guidelines regarding the design of CVM surveys. In addition to the NOAA report, Carson and Hanemann's (2005) contribution in the *Handbook of Environmental Economics* as well as Bateman et al.'s (2002) manual on stated preference techniques are primary references for the design of contingent valuation studies.

Design of the informative components and the hypothetical market

A careful design of part (2) of the questionnaire, which explains the environmental improvement to be valued to the survey participant, is of particular importance. This is because in many cases, CVM surveys deal with prospective environmental projects. Hence, the participants of a CVM interview might have never heard about the environmental good in question and, accordingly, have never thought about how much an increase in the provision or the protection of the same good would be worth to them. Thus, respondents have to undertake a quite challenging task when participating in the survey. Theoretically, they have to think about the utility increase they would experience subsequent to the realisation of a particular environmental project and translate this utility increase into monetary units. It is therefore extremely important that a CVM questionnaire contains an exact and detailed description of the expected environmental benefit. CVM practitioners often use pictures, maps and graphs to substantiate the written information. At the same time, the analyst has to make sure that respondents do not get bored during the survey because of too much or too complex information (cf. Carson and Hanemann, 2005).

Setting up a hypothetical market (part (3) of the questionnaire) in which the environmental good is traded lies in the heart of any CVM study. One central issue is the choice of a suitable **payment vehicle**, i.e. the means by which people hypothetically pay for the prospective provision of the environmental good. Researchers have the choice between taxes, fees, voluntary contributions and other kinds of payment vehicles. The payment vehicle should be both credible and accepted by the respondents (ibid.). Many studies employ tax payments as payment vehicles, especially when the environmental project in question requires long-term funding. However, announcing a tax increase can lead to a rejection of the valuation exercise due to many people's general opposition to increasing taxes. In view of this issue mandatory contributions to funds or the introduction of a particular fee are often more suitable payment vehicles than taxes. In addition to explaining how people would make their monetary contribution to the environmental project, the questionnaire should also provide information on the magnitude of the final payment, the frequency of payment and the institution responsible for collecting and managing the money (the so-called **payment rule**). Both issues critically depend on the environmental project in question and also on institutional settings in the country where the survey is conducted. The last element of the payment scenario is the **implementation rule** that includes information about how the survey results will be used by decision makers when determining whether the project should be implemented or not. The NOAA panel recommended to frame the value elicitation question as a referendum. This guideline also prescribes a particular implementation rule, namely that the environmental project will be implemented only if at least 50% of respondents agree to contrib-

ute a specified amount of money. Alternatively, if the value elicitation question is not a majority-vote-like referendum question, respondents should be informed under what circumstances the project will be realised. Hence, a properly designed implementation rule gives the participants of a CVM survey the impression that the survey outcome matters for government representatives' decision regarding the implementation of the environmental project in question. The latter aspect is of great importance since it decreases the likelihood that respondents make meaningless WTP statements (see Freeman et al., 2014: 403).

Design of the payment question

The design of part four of the questionnaire involves the choice of an elicitation format, i.e. the way of formulating the payment question and the associated answer options. Different kinds of elicitation questions and response formats have been developed, applied, refined and sometimes abandoned over the many years of CVM research. The oldest of all formats is the **bidding game** introduced by Randall et al. (1974). Bidding games imitate auctions by asking the respondent whether he or she would pay a particular price for the environmental good of concern; if the answer is 'yes', the bid is increased until the respondent rejects to pay the proposed amount of money. The highest bid the respondent tolerates to pay is interpreted as his or her maximum willingness to pay. If the initial answer is 'no', the iteration proceeds downwards until the respondent gives a positive response. A major problem inherent to this elicitation format is that the starting bid tends to influence the value respondents assign to the good in question (c.f. Mitchell and Carson, 1989). Several studies showed that the WTP amounts are affected by the initial bid: the higher (lower) the initial bid is, the higher (lower) the maximum price respondents agree to pay. Due to this so-called starting point bias the bidding game is hardly used anymore. The primary elicitation formats that have persisted are the open-ended, payment card and dichotomous choice formats and their variants (c.f. Boyle, 2003). An overview of these three main elicitation formats is given in Table 2-1.

Open-ended elicitation questions directly ask respondents to state their maximum willingness to pay for an environmental improvement. However, answering such a question is an unfamiliar task for most respondents. Empirical evidence shows that many respondents have difficulty in dealing with open-ended questions and opt for not giving any response. As a consequence, the rates of item nonresponse (i.e. the number of missing answers to the payment question) in surveys employing the open-ended format are often intolerably high (c.f. Venkatachalam, 2004). The **payment card** approach is less prone to this issue. It employs a range of money amounts or intervals listed on a card from which respondents pick the value that comes closest to their maximum WTP. Compared to the open-ended question, the payment card facilitates the valuation task significantly thereby decreasing the share of missing WTP statements. An unfortunate drawback of the payment card is that the range and the location of the money amounts displayed on the payment card may affect a respondent's answer (c.f. Mitchell and Carson, 1989). The third elicitation format simplifies the respondent's valuation task even further. **Dichotomous choice** (DC) questions ask survey participants whether they would give up a particular amount of

money in order to obtain a particular environmental improvement or not. These questions are typically framed as a referendum, asking the respondents whether they would vote in favour of an environmental project although it would imply higher public charges to them. For this reason, the terms 'referendum format' or 'take-it-or-leave-it approach' are often used a synonyms for the DC format.

Table 2-1: Overview of value elicitation formats

(adapted and modified from Boyle (2003): 137)

	Open-ended	Payment card	Dichotomous Choice
Method introduced by	Hammack and Brown (1974)	Mitchell and Carson (1981)	Bishop and Heberlein (1979)
Short description	Respondents are asked how much they would pay for the environmental good	Respondents are asked to indicate their WTP for the environmental good on a card containing a series of alternative payment amounts	Respondents are asked whether they would pay a certain, predefined amount in order to obtain the environmental good
Exemplary elicitation question	'How much would you pay?'	'What is the highest amount you would pay?'	'Would you pay €___?'
Variants		Two step WTP-question (e.g. Meyerhoff and Liebe, 2006) ('Would you pay something?'; 'If yes, please indicate the amount you would pay')	Multi-bounded dichotomous choice (Carson et al., 1986) Trichotomous choice (Loomis et al., 1999)

In difference to open-ended and payment card questions, the DC format brings to mind real life situations. Answering a DC question resembles the everyday task of deciding whether or not paying a specified price for a desired good. Voting in favour or against a policy proposal is also a task that most people living in a participative democracy are familiar with. Due to the comparatively easy decision task, response rates to DC questions are generally higher than for open-ended or payment card formats (cf. Bateman et al., 2002). Furthermore, based on experience, the DC format normally speeds up the interview process because fewer respondents challenge the interviewer to explain the valuation task again and because they need less time to think about their answer as compared to open-ended or payment card questions. The main disadvantage of the DC format is that maximum WTP cannot be directly inferred from a respondent's response. The information gained from a 'yes' response is that the respondent's WTP must be equal or higher than the specified amount; in case of a negative response the specified amount can be interpreted as an upper bound of a respondent's maximum WTP (cf. Freeman et al., 2014). Hence, confronting all respondents with an identical question regarding one particular price to be paid in exchange for an environmental improvement would be little informative. In order to de-

rive a sound measure for WTP, respondents are randomly assigned to different money amounts from a set of predetermined bids. Based on the answers of all survey respondents, a so-called bid function can be estimated. The bid function relates the likelihood of agreeing with the DC question to the different payment amounts employed in the survey. In other words, the bid function ideally shows how the likelihood of 'buying' the environmental good decreases when its 'price' increases. The sample's average WTP can be estimated based on these functions using econometric techniques. Section 6.3.2 gives an overview of the corresponding econometric framework.

In the original variant of DC, introduced by Bishop and Heberlein (1979) and Bishop et al. (1983), respondents have to make their decision of supporting or not supporting a particular public project after having been confronted by one single bid. Therefore, this kind of elicitation format is also known as single-bounded DC. Variants of the DC format, so-called **multi-bounded DC** models, use follow-up questions where respondents are randomly assigned to a lower bid in case of a negative answer to the initial question or a higher bid in case of a positive answer. Such a follow-up question can be asked once (double-bounded DC) or several times. Multi-bounded DC was developed to overcome 'the inefficient nature of the standard take-it-or-leave-it offer' (Mitchell and Carson, 1989: 103), by increasing the information that can be gained from a sample. For example, if a respondent's true maximum WTP is €6 and the randomly assigned bid is €10, he or she will reject €10 in a first step but accept €5 in a second. In the case of a single-bounded DC question the researcher knows that the true value lies between €0 and €10, while the double-bounded DC format suggests that it lies between €5 and €10. Hence, the information gained from the double-bounded DC format is more precise so that smaller samples and weaker statistical assumptions are required than for single-bounded data (cf. Bateman et al., 2002). Besides these advantages, it has been found that, similar to bidding games, respondents tend to anchor their response to the follow-up valuation question on the initial bid (c.f. DeShazo, 2002). Furthermore, the credibility of a CVM survey is likely to be reduced when an interviewer starts 'bargaining' with the respondent by offering him or her higher or lower prices of the environmental good. Hence, the advantage of being statistically more efficient than standard DC seems to be outperformed by several disadvantages of the multi-bounded DC format.

Loomis et al. (1999) proposed another variant of the referendum format, namely the so-called **trichotomous choice** format. As can be inferred from its name, a third answer option is added to the standard yes-no format. This third option gives respondents the possibility to let the researcher know that they would vote in favour for the project if it implied lower costs to them than the assigned bid suggests (c.f. Loomis et al., 1999). An example of the wording of this third option is, 'No, but if the amount was lower, I would support the project'. The idea of adding such an option to the response format results from the concern that many respondents tend to give socially desirable or politically correct answers when asked a standard referendum question. Hence, these respondents are likely to answer 'yes' even if the assigned bid exceeds their true WTP. The inclusion of a third answer option potentially helps to reduce the share of such untruthful 'yes' responses.

In addition to the choice of the elicitation format, the selection of bids, the so-called **bid design**, is critically when payment cards, DC or one of its variants are used in a CVM survey. This is because the number and range of bids can affect the estimated variance and hence the reliability of WTP measures (c.f. Kanninen, 1995). When using a payment card a researcher has to make sure that the range of payment intervals displayed on the payment card covers the range of true WTP amounts. In particular, the maximum bid, which should be chosen only by an insignificantly low number of respondents, has to be identified during pretests. Due to its statistical properties, the bid design requires even more pretesting in the case of DC questions. Cooper (1993), Kanninen (1993) and Alberini (1995) developed different theoretical criteria to increase the statistical efficiency of DC models. However, the underlying assumption of all optimal bid design methods is that the distribution of WTP is known prior to the execution of a CVM survey. Since this is virtually never the case, these methods cannot be applied in practice. Therefore, the choice of bids is usually based on rule-of-thumbs such as Kanninen's (1995: 123) recommendation 'to keep bids within the 15^{th} to 85^{th} percentiles' for a single-bounded DC format. The lowest bid, which should be accepted by 85% of the survey respondents, and the highest bid ideally rejected by 85% of the respondents, have to be identified during the preparation phase of the survey. Hence, in most practical applications, the final set and range of bids is the result of an, in many cases time-intensive, trial and error process.

Besides a careful selection of bids, increasing the sample size usually decreases bias and variance of WTP derived from DC-data (c.f. Kanninen, 1995). The need for relatively large sample sizes is, however, one of the main disadvantages of the single-bounded DC format. The NOAA Panel recommended using at least 1,000 valid observations, which is considerably more than the minimum number of observations necessary to reliably estimate WTP based on open-ended or payment card data. Furthermore, due to the comparatively complex bid design, a great number of pretest interviews are usually needed in the case DC-surveys. Both aspects increase the costs of a CVM survey.

Despite these issues, the choice of the elicitation format has also consequences for a researcher's possibilities to identify and treat meaningless value statements when analysing CVM data. For example, analysing the validity of zero WTP statements (so-called zero bids) is not possible when a standard DC format has been used because binary choice data only indicates whether a respondents' WTP is higher or lower than the assigned bid. In contrast to that, respondents can unambiguously indicate that they are not willing to pay anything for a particular environmental good when presented an open-ended question or a payment card. Likewise, the trichotomous choice format is suitable for such an analysis because researchers can include a particular answer option that allows accounting for zero WTP (e.g. 'No, I don't want to pay anything for this project'). Taking the role of money attitudes in CVM surveys as an example, assessing WTP by means of the prominent single-bounded DC format limits a researcher's reporting and analysis options substantially. This is because the presumably meaningless zero WTP statements of misers would be hidden behind the 'no'-option, which is supposed to cover the preferences of all

those having a WTP that is lower than the assigned bid. For this reason, only open-ended, payment card and TC questions offer the possibility for exploring the consequences of having extremely stingy respondents in one's sample.

Finally, the question arises whether assessing WTP by means of a referendum question is worth its comparatively high costs. Put differently, does DC yield more accurate value estimates than alternative elicitation formats? Many comparison studies showed that DC-based WTP estimates are higher than WTP estimates derived from open-ended or payment card data (c.f. Boyle, 2003). The reasons for such differences are relatively well understood and will be discussed in section 2.3.2 (see 'elicitation effects'). It is, however, still an open question which elicitation format provides the most accurate WTP data. As already mentioned, Arrow and Solow (1993) recommended the use of DC questions for practical CVM studies. Until today, DC and its variants is the most frequently applied elicitation format, but it is not absolutely clear that DC is indeed superior in its capacity of providing coherent value estimates as compared to alternative elicitation formats. In the end, the choice of the elicitation format depends on many study-specific factors such as the population to be surveyed, the survey mode, a researcher's methodological interests and, of course, the available budget.

Interpretation of WTP statements

As explained in section 2.2.1, economists interpret individual WTP statements in terms of the Hicksian compensating variation. Just as the CV, an individual's value statement is supposed to be monotonically related to the utility change that would accrue to the individual if the environmental project in question was realised. Therefore, a positive WTP statement is generally interpreted in terms of a utility increase. In other words, respondents with a non-zero WTP would be better-off if the environmental project was implemented, according to the standard interpretation. By contrast, respondents who are not willing to sacrifice a single cent would experience no utility gain. Furthermore, analysts do not only focus on a respondent's general willingness to give up some money in exchange for an environmental improvement but also interpret the amount of money a person would sacrifice. The higher the amount of money a respondent tolerates to contribute to a particular environmental project is, the higher the utility increase he or she expects to experience if this project was implemented. Table 2-2 summarises the assumed relationship between WTP and a person's wellbeing.

Analysing group-specific WTP statements, for example the average WTP of men, of elderly people or of graduates turns out to be helpful for the prediction of the distributional effects of an environmental project. Comparing the scope of WTP across socio-demographic groups enables a researcher to identify the losers and the winners of an environmental project. However, there are a number of reasons that call the standard interpretation of WTP statements assessed in a CVM survey into question. Under certain circumstances, the monotonic relationship between an individual's utility and WTP may be distorted. In the environmental valuation literature, WTP statements which do not or not adequately relate to the actual utility increase a respondent would experience if the environmental project to be valued was realised, are termed biased WTP state-

ments. Probably the most popular example of biased WTP statements are the answers of respondents who perceive the payment question as purely hypothetical and therefore state an implausibly high WTP (see 'hypothetical bias' in section 2.3.2). Another hitherto overlooked source of bias is the presence of misers in the CVM sample. People who hate spending money on anything in any situation most likely also refuse to contribute money to any environmental project, irrespective of the kind and scope of environmental improvement caused by the associated measures. If misers behave the same way on hypothetical markets as on actual markets, they will always state a zero WTP. Such WTP statements can be judged as truthful because they correspond to misers' actual WTP, like the amount of money a miser would spend in a simulated market experiment. However, they are meaningless in the sense that they do not refer to the utility increase misers would experience due to enhanced environmental conditions.

Biased WTP statements pose problems because they threaten the validity of the overall value estimate derived from a CVM survey. If a significant share of respondents has stated a WTP which is essentially unrelated to the value they attach to the environmental project, the sample's average WTP will be biased as well. Furthermore, if the overall social value of the environmental project in question is based on such a biased figure and used as an input for a cost-benefit analysis, the outcome of this cost-benefit study might be misleading. Accordingly, the share of biased WTP statements in a CVM survey must be minimised. Different kinds of biases, their sources and strategies to minimise biased WTP statements in a CVM survey are discussed in the environmental valuation literature (cf. section 2.3.2). Some of these biases, for example protest against some aspects of the payment scenario, can be minimised through a careful survey preparation. Other kinds of biases, for example miserliness, will always occur and should be tackled subsequent to the data collection. Since it is unavoidable that stingy people are interviewed in a representative CVM survey, the only strategy for minimising the bias of the survey results consists of identifying these problematic respondents ex-post so that their WTP statements can be discarded from the data if necessary. For this purpose, the inclusion of well-formulated and carefully tested auxiliary questions is of particular importance.

Table 2-2: Interpretation of WTP statements

WTP	**Utility change (ΔU_h^{01})**	**Interpretation**
zero	$U_h^1 = U_h^0$	The individual would not be better off if the environmental project was realised.
low	$U_h^1 > U_h^0$	The individual would be somewhat better off if the environmental project was realised.
high	$U_h^1 > U_h^0$	The individual would be substantially better off if the environmental project was realised.

Inclusion of auxiliary questions

For the analysis of WTP statements, especially in view of validity checks and data cleansing, comprehensive data is needed. Therefore, CVM practitioners collect **socio-demographic information** (respondents' gender, age, income, etc.) as well as other data that is likely to explain a respondent's motivation to give a certain answer to the payment question. A set of **debriefing questions** is usually asked directly after the elicitation question. Answers to these questions can then be used to verify the plausibility of individual WTP statements. There are two kinds of debriefing questions, namely those to explain why respondents are willing or unwilling to pay for the environmental project of concern and those to scrutinise respondents' impressions of the project scenario (c.f. Bateman et al., 2002). The first set of questions help to assess whether a respondent's answer is affected by certain characteristics of the hypothetical market. As will be discussed in section 2.3.2, WTP statements which reflect, for example, a respondent's negative attitude towards the elicitation question or the payment vehicle reduce the validity of the overall value estimate derived from a CVM survey (see 'protest bids' in section 2.3.2). The second type of debriefing questions helps to find out whether respondents have perceived the project scenario as meaningful and credible. Answers to these questions are particularly useful to check whether respondents have overlooked their budget constraint and/or behaved strategically when making a value statement (see 'hypothetical bias' and 'strategic behaviour' in section 2.3.2).

Furthermore, the interests of the researcher essentially determine the contents of the last part of the questionnaire. In addition to collecting socio-demographic information and asking debriefing questions, it has become common practice to integrate psychological instruments into CVM questionnaires. Psychometric inventories make **psychological variables** such as particular attitudes or personality traits measurable. For instance, several CVM studies (e.g. Spash, 2006, Ojea and Loureiro, 2007, Meyerhoff, 2006) addressed the question whether general attitudes and ethical beliefs towards environmental preservation affect WTP estimates by integrating the 'New Environmental Paradigm Scale' (Dunlap et al., 2000, Dunlap and Van Liere, 2008) or similar question inventories developed by Paul Stern and colleagues (Stern et al., 1993, Stern et al., 1995, Stern, 2000) into their surveys. Moreover, Frör (2008) used techniques borrowed from cognitive psychology to detect different types of information processing modes and to analyse how these information processing modes affect respondents' answers to the payment question. In a recent paper, Börger (2013) used an inventory to measure respondents' tendency to give socially desirable answers and showed how this variable affects the results of a CVM survey. In the present study a money attitude scale will be integrated into an exemplary CVM questionnaire in order to measure respondents' attitudes towards spending money in general. This inventory offers the possibility to construct a variable that indicates different levels of miserliness. As explained before, assessing the relationship between attitudes towards spending money and WTP as well as scrutinising the WTP statements of extremely stingy respondents may alter a researcher's understanding of the key determinants of WTP statements. Focussing on this hitherto overlooked psychological variable may also enhance the validity of CVM surveys.

Unfortunately, the identification of one single psychological construct often involves an extensive number of questions. In many cases, these attitudinal questions are somewhat complex so that respondents generally need some time to think about their responses. On the one hand, accounting for psychological variables certainly contributes to a better understanding of the factors determining individual WTP statements. On the other hand, this undertaking may overwhelm some participants of a CVM survey. Hence, taking account of potentially relevant individual difference variables while not overburdening a respondent with apparently unrelated questions is another issue that needs to be carefully considered when designing and testing a CVM questionnaire.

Survey modes and sampling

Apart from carefully designing the CVM questionnaire, researchers have to decide on more technical issues such as the survey mode, the sampling method and the sample size. As in the case of other survey-related issues, CVM practitioners have to make trade-offs between the cost and the quality of the survey and adapt to the institutional and cultural context of the survey site. A first challenge consists of finding a suitable **survey mode**. CVM data can be gathered through personal interviews, telephone, mail or web-based surveys. Due to the recruitment, training and payment of interviewers, personal interviews are the most costly of all survey administration modes. Still, personal interviews are preferable to telephone, mail or internet surveys for several reasons. They have advantages over alternative survey modes in view of the representativeness of the sample (see Bateman et al., 2002: 103). The selection of respondents is ideally based on a random selection of households from registration lists. If interviews are conducted at a reasonable time of the day, for example in the evening when most people are at home, each individual of a population has the same probability to be interviewed. Mail, telephone and internet surveys, in contrast, systematically exclude certain groups of the population, namely those who have no telephone, no internet connection and those who are illiterate. While the latter point might not be seen as a problem when conducting a CVM survey in industrialised countries, it should be considered in developing countries or in study sites where a considerably large part of the population or certain groups within the population have received little education. A related issue is the response rate, which is generally higher in personal interviews than in self-administered or telephone interviews (see Bateman et al., 2002: 102). A low response rate can affect representativeness of the sample, for instance when particular groups of the population such as the working population or people with lower levels of education, are less likely to participate in the survey than others. Moreover, researchers have a higher degree of control over the survey process in personal interviews than in mail or internet surveys. With the presence of an interviewer it can be ensured that respondents do not leave out any sections of the questionnaire thereby reducing item nonresponse (ibid.). Moreover, the interviewer can take notes concerning the respondent's motivation and reaction to certain questions. It can also be expected that respondents are more attentive and willing to participate in a time-intensive survey when interviewed personally. CVM questionnaires often contain long text passages and complex questions so that it is hardly possi-

ble to conduct the survey on the phone. The presentation of visual material such as maps, graphs and pictures makes the valuation task easier but also excludes telephone surveys from the administration modes at choice. Based on experience, personal interviews have several advantages over alternative surveys modes but certain weak points should also be kept in mind. Besides being more costly than other survey modes, the major drawback of personal interviews is the so-called interviewer bias. The answer to the payment question, in particular, might be influenced by the presence of an interviewer. This would be for instance the case when a respondent wants to please the interviewer by giving political correct responses or, on the contrary, wants to make the interviewer angry by giving crude responses (see Stephan and Ahlheim, 1996: 67). As highlighted by Bateman et al. (2002), the interviewer bias can be partly corrected by rigorously training the interviewers prior to the survey.

Regarding the **sampling technique**, it is clear that a randomly selected household sample is preferable whenever the results of a CVM study shall be generalised and used as an input for practical cost-benefit assessment. Drawing inference from a sample to the general population requires that the chance of being included in the sample is the same for each member of the population in question (see Carson and Hanemann, 2005: 903). However, random sampling is only feasible when a complete sampling frame of the population under consideration exists and is available for the researcher. If this is not the case, alternative sampling techniques such as random walks or quota sampling need to be applied. In the case of random walks interviews have to be conducted at people's apartments; quota-based intercept surveys allow for a more flexible selection of interview spots. On the one hand, a respondent's apartment is a very suitable location for conducting a CVM interview because respondents interviewed at home may be more likely to concentrate and to focus on the questions than those interviewed in public, potentially busy and noisy places. On the other hand, the conduct of household interviews can be extremely difficult when people are hesitant to open their doors to strangers or when the interviewers have no access to people's homes. For example, if it is likely that most interviewers will be stopped by security guards when trying to enter an apartment building, the conduct of household interviews is little promising. In some cases, intercept interviews are a more efficient way to collect CVM data.

The required **sample size** is immediately related to the sampling technique and the elicitation format used to assess WTP. A way of ensuring representativeness of small samples consists of selecting respondents along certain predefined criteria, such as gender and age (quota sampling). Representative probability samples, in contrast to this, require bigger sample sizes. Furthermore, due to the statistical properties of dichotomous choice models, surveys using this format require higher numbers of observations (at least 1,000) than those using open-ended or payment card formats.

2.3.2 Validity and reliability of stated WTP

As highlighted before, assessing environmental values by means of surveys is prone to a lot of criticism. This criticism mainly circles around aspects concerning the validity and reliability of

value estimates, i.e. the WTP figures, assessed in stated preference surveys. Validity refers to the question whether an environmental valuation method actually measures the theoretical construct of interest which is the true economic value of an environmental project (see Venkatachalam, 2004: 90). Reliability refers to the consistency of an estimate in general and to the question whether the estimate for a particular environmental good can be reproduced in particular (ibid: 91). Since the earliest applications researchers have pointed to a number of errors and biases affecting the validity and reliability of contingent valuation estimates. The present section is devoted to the criteria for determining the quality of environmental value estimates and the discussion of potential errors and biases in CVM surveys.

Judging the quality of CVM data

In his extensively cited overview article on contingent valuation Venkatachalam (2004) suggested two possibilities for testing the **reliability** of a CVM value estimate. The first option is to compare the result of a CVM survey to values obtained from alternative environmental valuation methods (TCM, hedonic pricing, etc.). Alternatively, researchers may repeat the same survey several times and compare the results obtained from the different datasets (test-retest method). Ideally, the value estimates for a particular environmental good derived from different methodologies or survey waves are approximately the same. Carson et al. (1996) conducted a meta-analysis and compared CVM value estimates for a number of quasi-public goods to revealed preference-based values for the same goods. The authors found that CVM values were not statistically different from those derived from revealed preference techniques and concluded that CVM estimates are reliable. The meaningfulness of comparing stated preference method estimates with revealed method estimates is, however, to be questioned. Discrepancy between method-specific values may result from the methodological weakness of stated preference techniques but also from a lack of validity of revealed preference techniques (c.f. Freeman et al., 2014). Hence, the test-retest method represents a more accurate reliability test. Most of the published studies which used the test-retest procedure argued for the reliability of WTP estimates (c.f. Venkatachalam, 2004).

Reliability tests are relatively easy to conduct and can be used to show that CVM value estimates are ‘reproducible’. However, reliability assessment gives no insight into the question whether the number assessed in a CVM survey represents the ‘true’ value of an environmental good, i.e. whether the value is unbiased and thus valid. **Validity assessment** of CVM measures is complicated by the fact that the true economic value of most environmental goods is unknown. Hence, the standard procedure of comparing the stated preference measure with an objective measure, like a good’s market price, is usually not feasible. For this reason, the validity of stated WTP needs to be investigated through less direct approaches. One possibility consists of comparing the stated value assessed in a CVM survey with the value observed in a simulated market study. Alternatively, validity can be assessed by asking whether the results are consistent with economic theory and whether the study was conducted in accordance with the general guidelines

of best practise (c.f. Freeman et al., 2014). These approaches focus on different types of validity which shall be introduced briefly now.

Criterion validity testing involves the comparison of a CVM value estimate to an alternative measure which is chosen as a criterion. Since the most frequently used criterion, market price, is unknown in the case of most environmental goods, researchers have turned to experimental methods where environmental goods are traded on simulated markets and participants make actual transactions (c.f. Freeman et al., 2014: 400-401). WTP assessed in the laboratory often serves as the criterion and is compared to hypothetical responses to WTP questions. In addition to that, some researchers investigated the validity of CVM values by means of comparative field experiments. Most of them made use of two independent samples, where respondents of one sample were asked to state their WTP for a particular good while the respondents of the other sample were asked to actually make a payment for the same good, for instance in the form of a donation (cf. e.g. Foster et al., 1997, Brown et al., 1996, Vossler and Evans, 2009). The results of criterion validity studies demonstrate that hypothetical payments are persistently higher than actual payments indicating an upward bias of CVM value estimates (see Freeman et al., 2014: 401). A lack of criterion invalidity, which is often referred to as the 'hypothetical bias' in CVM surveys, is one of the main arguments against the use of stated preference methods for the estimation of environmental values.

Another type of validity which has caused lots of debates concerning the methodological soundness of CVM is **construct validity**. Construct validity is fulfilled if the results of a CVM study are consistent with the underlying principles of economic theory (see Venkatachalam, 2004: 91). Hence, WTP should be predicted by the variables that economic theory suggests being related to WTP and unaffected by variables that are irrelevant from the theoretical point of view. Perhaps the most essential relationship that can be deducted from economic theory is that the demand for a good should be responsive to its price. Accordingly, the probability of agreeing with a CVM referendum question should fall as bid levels rise. Checking for construct validity has become a standard element in empirical CVM studies. It involves the employment of econometric models where the WTP variable is regressed against a number of explanatory variables such as the price of the environmental good (i.e. the bid level in DC-based studies) and respondents' income. Other characteristics of the respondents, like their education, age, employment status, environmental attitudes, etc. are typically also considered. Once again, several studies provided rather puzzling results which have been cited as evidence for construct invalidity of CVM-based value estimates. For example, WTP has been often found to be unrelated to respondents' income. From a theoretical point of view, the absence of a positive income effect does not challenge the validity of the welfare measure (cf. Ahlheim, 1998a, Flores and Carson, 1997 who demonstrate that the compensating variation does not refer to an individual's actual income). Nevertheless, the fact that the magnitude of WTP often does not increase with income reveals that respondents tend to overlook their budget constraint when answering hypothetical WTP questions and exaggerate their actual WTP.

In addition to income effects, sensitivity to scope is an indicator for construct validity. In line with economic theory, an increase in the quantity or quality of the environmental good of concern should result in higher value estimates. Construct validity is therefore often assessed by means of a so-called scope test, a technique that consists of comparing respondents' WTP for different quantities of the environmental good or different numbers of protection measures encompassed by the environmental project in question. A CVM study passes the scope test only if WTP increases with quantity. Prominent examples of CVM studies that applied scope-tests are those by Kahneman and Knetsch (1992) and Desvousges et al. (1993). These authors found that WTP estimates were insensitive to variations of the environmental good and concluded that CVM lacks criterion validity.

Finally, **content validity** has to be added to the list of criteria used to judge the quality of a CVM survey. Content validity refers to the question whether the CVM survey has been conducted conforming to the general guidelines of best practice (see Freeman et al., 2014: 408). The assessment of criterion validity involves an examination of the survey instrument, especially the design of the project and payment scenario as well as the elicitation question. Furthermore, procedural matters such as the sampling method, the sample size and issues related to the analysis of data need to be investigated (ibid). However, questions regarding the best practise for designing and implementing a CVM survey are not always simply to answer. As shown in section 2.3.1, there are multiple options concerning the questionnaire design, the interview and the sampling method. In spite of its advanced age, the guidelines formulated by the NOAA panel (Arrow and Solow, 1993) continue to be one of the most influential references. In the previous section several elements of the NOAA guidelines for the conduct of CVM surveys have already been mentioned. For example, the panel put emphasis on the use of probability sampling, personal interviews and highlighted the importance of pretesting the scenarios and visual material as well as of using debriefing questions concerning a respondent's reasons of answering the value elicitation question in the way he or she did. While most studies (according to what is reported in publications) are conducted in line with the latter standards of best practise, there is a lot of discussion concerning some other issues related to the survey design. For example, different opinions about the choice of the payment vehicle and the elicitation format exist. The NOAA panel approved the use of referendum questions on tax increases but designing the payment scenario in that way is not always recommendable. As already mentioned, tax increases may cause strong objections of the respondents, especially when citizens have high levels of distrust towards their government. Furthermore, the employment of referendum questions may complicate rather than simplify the value elicitation process when the survey population is not used to democratically voting on policy issues (cf. Whittington, 2002). Venkatachalam (2004) recommended that practitioners should be selective in using CVM guidelines, especially when conducting a survey in developing countries and in study sites where socioeconomic and institutional aspects are very different from western countries, where the NOAA guidelines and other manuals have their origins.

Regarding the four quality criteria, criterion invalidity and construct invalidity appear to be of most concern in the case of CVM studies. Lacks of accuracy in terms of gaps between actual payments and hypothetical value statements as well as counterintuitive findings concerning the covariance of WTP measures and economic variables put into question the usefulness of CVM as a tool for putting monetary values on environmental goods. Implausible results of CVM studies are attributable to errors related to the survey design, the survey implementation, mistakes when analysing the gathered data as well as to biased value statements.

Biases and errors in CVM surveys

The lists of biases and errors in CVM surveys that a reader finds in environmental valuation manuals are impressively long. Bateman et al. (2002), for example, provide details on 22 potential biases in CVM studies. It is out of the scope of the present work to address all of them. In the following paragraphs, only the most frequently discussed biases as well as some issues which have attracted the interest of only a few researchers but which are considered as relevant for the topic investigated in this dissertation will be reviewed briefly. The occurrence of biased WTP statements and other undesirable response patterns can be, to at least some extent, reduced by a careful preparation of a CVM survey. However, even the most diligent practitioner should keep in mind the potential biases and response abnormalities when analysing CVM survey data. For this reason, some possibilities to enhance the validity of value estimates ex ante to collecting the data as well as ways how to identify misleading WTP values when analysing the gathered data will be addressed in the following paragraphs.

A frequently discussed issue is the so-called **embedding effect**. The environmental good to be valued by the participants of a CVM survey is usually part of a more inclusive good. For example, an ecosystem restoration project in a particular region is part of the environmental protection policy of a country. Embedding occurs when a respondent's value statement refers to the more inclusive good (e.g. environmental protection) instead of the environmental good of concern (e.g. a particular environmental project). Consequences of this effect are that the results of CVM studies turn out to be insensitive to variations of the quantity of the environmental good in question or that two value estimates are approximately equal although one refers to a more inclusive and the other to a less inclusive project (see Venkatachalam, 2004: 96). Embedding affects construct validity because it violates the fundamental assumption that a rational consumer always prefers higher quantities to lower quantities of the same commodity (cf. Desvousges et al., 1993). Hence, embedding is the bias which relates to scope insensitivity of WTP estimates, which is one of the indicators of construct invalidity described above. The prominent critics of the method (e.g. Hausman, 1993, Hausman, 2012) often used the latter phenomena as one of the main arguments against the employment of CVM for the valuation of environmental goods. At the same time, more optimistic researchers like Mitchell and Carson (1989) highlighted that the problem of embedding can be reduced by adequately designing the project scenario describing the prospective environmental change in question. According to them, it is important that respondents understand that they should state their WTP for one particular good, like a particular

environmental project, and not for environmental protection in general. Apart from the questionnaire design, the survey mode can critically affect the occurrence of unreliable results. As stressed by Venkatachalam (2004), embedding is less likely to occur when respondents are concentrated during the interview and take their time to think about the information provided by the questionnaire. This highlights again the advantage of personal interviews conducted at an adequate spot compared to typically shorter telephone interviews or self-administered surveys where the researcher cannot control whether a respondent attentively reads the provided information.

An alternative explanation for the absence of scope effects focuses on a phenomenon that Andreoni (1990) introduced as the '**warm-glow of giving**'. Andreoni (1990) theorised that people who make charitable donations may receive utility from the act of giving itself and not, or not only, from altruistic feelings towards the recipients of their donations. In line with this idea a respondent's stated WTP may encompass a warm-glow component in addition to the welfare component accruing from the consumption of the environmental good in question. While the latter component of WTP is expected to vary with the scope of an environmental improvement, the warm-glow component is likely to remain stable across environmental projects of different magnitude (c.f. Nunes and Schokkaert, 2003). If WTP refers mainly to some 'purchase of moral satisfaction' (Kahneman and Knetsch, 1992) and to a lower or even negligible extent to the utility a respondent expects to gain from the environmental improvement to be valued, it is no wonder that WTP estimates are insensitive to the scope of this improvement. There have been debates regarding whether or not the warm-glow effect biases the outcome of CVM surveys. While some economists (e.g. Hausman, 1993, Arrow and Solow, 1993) argue that WTP statements which are motivated by the warm-glow of giving do not reflect genuine economic preferences, the warm-glow is considered as a legitimate component of WTP by others (e.g.Nunes, 2002, Ahlheim and Schneider, 1996, Carson et al., 2001).

The types of biases considered next refer to a respondent's tendency to (intentionally) misreport WTP, i.e. to exaggerate or to understate his or her actual WTP. The most prominent candidate in this group is the **hypothetical bias** which is defined as the potential divergence between stated and true WTP (see Venkatachalam, 2004: 110). This divergence is often explained by the hypothetical nature of the payment commitment in CVM surveys (c.f. Bateman et al., 2002). Critics argue that participants of CVM surveys do not properly observe their personal budget constraints and maintain that respondents fail to consider the stated amount in terms of forgone market consumption (c.f. Ahlheim, 1998a). As explained before, divergence between hypothetical and actual WTP threatens the criterion validity of a CVM value estimate. A first possibility to ameliorate the truthfulness of answers to value elicitation questions is the so-called 'cheap talk' script. Within the interview respondents are explicitly warned of the hypothetical bias of stated preference surveys and are asked to think about the hypothetical market as if it was real (c.f. Freeman et al., 2014). Another increasingly prominent approach consists of introducing elements of realism and consequentiality into the payment question. Carson and Groves (2007) highlighted the importance of asking payment questions which respondents perceive as realistic

and relevant for policy decisions. The likelihood that respondents make misleading WTP statements is expected to decrease when telling them, for example, that the survey results will be used by decision makers and that the future provision of the environmental good depends on the survey results. Furthermore, the CVM questionnaire should transmit the message that actual payments will be collected if the environmental project is implemented.

However, tackling the hypothetical bias by means of a consequential survey design and by making respondents believe that there will be actual payments may worsen another form of undesired response behaviour, namely **strategic behaviour**. In a CVM survey, strategic behaviour can take two forms: free riding and overpledging (c.f. Venkatachalam, 2004). Free riding means that an individual understates his or her true WTP in the hope that others' WTP is sufficient to ensure the provision of the environmental amenity. Overpledging occurs when the individual believes that a) the provision of the environmental good is more likely when he or she states a very high WTP, and b) that he or she will never have to pay the stated amount (ibid: 112). Of course, a rational individual has an incentive to act strategically only if he or she perceives the payment question as realistic and consequential. If respondents viewed the payment question as purely hypothetical, free riding and overpledging would not make any sense. Strategic behaviour can be prevented by designing the value elicitation question in a way that respondents have an incentive to answer it truthfully (c.f. Carson et al., 2001). Elicitation formats which ensure that giving a true answer to the valuation question is the respondent's best strategy are named 'incentive compatible' in literature (see Boyle, 2003: 131). In terms of incentive compatibility the DC format has some advantages over alternative elicitation questions. In the standard variant respondents are asked whether they would contribute €x (the randomly assigned bid) for the project under investigation. Furthermore, the referendum format typically gives them the impression that the project's implementation depends on the result of a majority vote by the survey participants and that final payments will be equal to the bid. Hence, if a respondent has a true WTP which is higher than the bid, his or her best strategy is to agree with the elicitation question because this increases the probability that the project is actually implemented. The contrary holds true for an individual whose WTP is lower than the bid (c.f. Heinke, 2013). Free-riding and overpledging is more likely to occur in CVM studies that use open-ended or payment card formats (see Carson and Hanemann, 2005: 878). Respondents, who fear that the final amount to be paid depends on their individual answer to the payment question, have an incentive to understate their true WTP if they believe that other people's WTP is high enough to ensure the project's implementation. Respondents, who believe that their answers are irrelevant for the final payment but matter for the outcome of the survey, have an incentive to overstate their true WTP since this alters the probability that the project is implemented. In her dissertation, Heinke (2013) demonstrated that the Becker-DeGroot-Marschak-method, which is an incentive-compatible payment mechanism, which is often used in experimental economics, helps to minimise the share of strategically motivated replies to open-ended WTP questions. The drawback of presenting an incentive compatible payment scenario is that the explanation of the payment mechanism becomes

longer and typically also more complex. Hence, the risk of obtaining strategically-motivated WTP statements has to be weighed against straining the respondents' patience.

Strategic behaviour is one reason for so-called **elicitation effects**. As already mentioned, several studies showed that different elicitation formants yield values of different magnitude for one and the same environmental good (c.f. e.g. Desvousges et al., 1993, Brown et al., 1996, Ready et al., 1996, Blaine et al., 2005). The widespread observation is that the WTP values assessed by means of DC questions are generally higher than open-ended or payment card values. In a meta-study Brown et al. (1996) found that the DC/open-ended ratio falls between 1 and 5, i.e. in the extreme case DC estimates were five times higher than estimates derived from open-ended formats. This divergence is most likely a result of respondents' tendency to strategically understate their true WTP when employing open-ended or payment card formats, on the one hand, and the absence of such understatements in the case of an incentive compatible referendum format, on the other (c.f. Venkatachalam, 2004). Furthermore, many respondents have a tendency to state lower WTP amounts when they perceive the valuation question as difficult, so that the lower estimates of cognitively more demanding open-ended formats compared to those derived from the simpler DC questions come as little surprise (c.f. Bateman et al., 2002). Finally, the issue of so-called yea-saying has been discussed as a reason for the relatively higher value estimates assessed in CVM surveys using the DC format (c.f. e.g. Holmes and Kramer, 1995, Blamey et al., 1999, Kanninen, 1995). Yea-saying refers to the tendency of agreeing with the specified bid to avoid the socially embarrassing situation to say 'no' (c.f. Bateman et al., 2002: 138). Hence, even if the bid is higher than the respondent's true WTP he or she might agree with the payment in order to show his or her favourable opinion towards the environmental project, leading to an upwards bias of overall WTP. It is useful to test and discuss different elicitation formats with respondents during the preparation phase of the survey, since yea-saying, strategic behaviour and the ability to deal with a rather complicated valuation question are often determined by the cultural background of the respondents.

Another type of answers which do not reveal a respondent's true preferences for the environmental project under investigation are so-called **protest bids**. CVM practitioners have observed that WTP statements often do not refer to the true value respondents attribute to the environmental improvement in question but are an expression of their rejection of some aspects of the hypothetical market (c.f. Meyerhoff and Liebe, 2006). Motivations underlying protest beliefs encompass certain attitudes towards government, rejection of the payment vehicle, fairness or ethical considerations. Protesting often translates into WTP statements of zero (so-called zero bids) or item nonresponse. At the same time, protest bids can also take the form of statistical outliers, i.e. implausibly high bids that exceed a respondent's true WTP (ibid.). Protest bids threaten the validity of CVM values if a significantly large share of respondents intentionally understates or exaggerates their WTP. In this case the sample's average WTP may not reveal the true social value of the environmental project in question. There is extensive literature concerning the underlying motivations, identification and treatment of protest bids in CVM surveys. Among oth-

ers, the articles by Jorgensen et al. (1999), Dziegielewska and Mendelsohn (2007) and Meyerhoff and Liebe (2006) provide good overviews of the topic. Similar to the hypothetical and the strategic bias, protest can be reduced by a careful survey design. During pretests, particular attention should be paid to the question how different provision scenarios, payment vehicles and elicitation formats are perceived by the respondents. However, like most sources of error and bias, protest beliefs can hardly be fully eliminated through a careful survey design. Therefore, the identification and treatment of protest bids is an essential element of the data analysis. As mentioned before, it is highly recommendable to integrate a set of debriefing questions into CVM questionnaires. Some of these questions help to detect protest responses when analysing the data. For instance, a zero WTP combined with a high level of agreement with a statement such as 'It is unfair to be asked to pay additional money for a public good' (Jorgensen and Syme, 2000: 258) reveals protest. Nevertheless, the interpretation of protest responses is difficult and there is no well-established technique that allows for a clear differentiation between protest zeroes and true zeroes, i.e. separating the valid answers of respondents who expect that they would not benefit from the environmental project from invalid, protest-motivated answers. The treatment of positive bids in combination with agreement to several attitudinal questions indicating protest beliefs is even more debatable. In addition to the problem of correctly identifying protest responses, their treatment when aggregating individual WTP remains an open question among CVM researchers (c.f. Meyerhoff and Liebe, 2006). The exclusion of protest bids often implies a significant reduction of the sample size and may also affect the representativeness of the sample if protesting is more likely to occur among certain groups within the population than in others. Therefore, instead of excluding protest bids from the analysis, analysts should check whether protesting significantly affects the WTP estimate and let the recipients of the survey results know about it (ibid.).

Another issue which threatens the validity of CVM values estimates is the existence of survey participants who do not make trade-offs between the preservation of the environmental good in question and their income, for example because they believe that the environmental good has an absolute right to protection. Some researchers classify this kind of behaviour as a form of protest against the payment question. Others explore the choices of respondents who refuse to make trade-offs in terms of **lexicographic decision rules** (c.f. Haddad and Howarth, 2006). Protest is usually associated with giving untruthful responses on purpose. Employing lexicographic decision rules, in contrast, is a highly problematic but truthful expression of preferences. A respondent who uses a lexicographic decision rule makes binary choices among alternatives thereby exclusively focusing on the good he or she considers as most important regardless of what happens to other goods. For example, a respondent who thinks that environmental protection has absolute priority may refer to a decision rule such as 'more environmental protection is always better than less, irrespectively what happens to my personal welfare' (Edwards, 1986: 147); and a respondent who is extremely stingy may behave according to the rule 'more money is always better than less, irrespectively what happens to the environment'. The common characteristic of both stereo-

types of man – the environmentalist on the one hand and the miser on the other – is that there are no two alternatives that leave them indifferent. No amount of money will compensate the environmentalist for a decrease in environmental quality and no environmental improvement will compensate the miser for a decrease in his or her financial resources. The problem of respondents refusing to play the game, i.e. unwillingness to make trade-offs between the environmental good and money, violates a fundamental assumption on individual preference orderings underlying the utility function (the continuity axiom, c.f. e.g. Ahlheim and Rose, 1992: 250). This is extremely critical because the WTP statements of respondents whose preference ordering does not fit the standard microeconomic assumptions cannot be interpreted as meaningful welfare measures. Thus, if it is expected that a considerable number of respondents act in a way that is not in line with the microeconomic consumer model, the questionnaire should include some instrument that helps to identify these respondents when analysing the survey data. The relevance of lexicographic preferences in CVM surveys was highlighted by Edwards (1986) for the first time. He introduced the behavioural stereotype of a respondent with so-called ethical preferences who is motivated exclusively by an unselfish interest of preserving environmental goods. He stressed that in the lexicographic model, WTP for an environmental improvement cannot be interpreted in terms of the compensating variation and that economists shall test whether the problem of respondents who employ lexicographic decision rules is of empirical matter. Practical approaches concerning the detection of the WTP statements of respondents with lexicographic preference structures can be found in Spash (1998), Rosenberger et al. (2003), Rekola (2003) and Veisten et al. (2004). These authors used sets of attitudinal statements to be ranked on agree-disagree scales. A respondent's agreement or disagreement with several statements was believed to indicate whether he or she employed a lexicographic decision rule when answering the payment question. Rosenberger et al. (2003), for example, asked respondents whether or not they agreed with the statements 'Endangered wildlife species should be protected at any cost' and 'Unique environments should be protected at all costs'. According to the outcome of these studies, the share of respondents with lexicographic preferences for environmental resources is of empirical importance; it amounts to approximately 25% in Stevens et al. (1991), 23% in Spash and Hanley (1995) and 8% in Veisten et al. (2004).

Furthermore, analysts found that the WTP statements of respondents who attaches absolute priority to the environmental good in question resemble protest bids, i.e. they are or extremely high, zero or missing. Unusually high WTP amounts are in line with the lexicographic model because an individual who considers the environmental good as immeasurably more important as any market good would offer his or her entire disposable income to get the environmental improvement realised. At the same time, if a respondent believes that the environmental resource has an absolute right to protection he may reject the valuation task by stating a zero WTP or refusing to give any answer (cf. Haddad and Howarth, 2006). Similar to protest bids, there is no agreement on how to identify respondents with lexicographic preference structures and whether their WTP statements should be discarded from the data or not. Furthermore, it is to be noted that

the discussion of lexicographic preferences has been limited to preference orderings where the environmental good has absolute priority over other goods. No attention has been paid to the other side of the coin, namely to respondents who attach absolute importance to the accumulation of financial resources. So far, the question whether the share of respondents fitting the behavioural stereotype of the miser, i.e. an individual who is exclusively focussed on money, is of empirical matter or not has never been asked. As a consequence, no method that allows for an identification of such respondents has been developed. This gap of research shall be reduced in the empirical part of the present work.

Finally, a subject of discussion that I will call the '**numéraire effect**' shall be addressed before concluding this section. Apart from pointing to the existence of respondents who are unwilling to make trade-offs between environmental goods and their financial resources, some researchers have questioned whether money is actually an effective measuring rod for the assessment of environmental values. Even though assessing WTP in terms of money is common practice among CVM analysts, the theoretical welfare measure underlying the WTP concept does not prescribe that WTP must be assessed in monetary terms. The central question to be answered by the respondents of a CVM survey is how much utility in terms of *market consumption* they would give up to obtain the utility they expect to experience thanks to the environmental improvement (c.f. Ahlheim et al., 2010b). Hence, WTP is merely a measure of forgone market consumption and not directly of money spent. However, in order to make individual utility changes comparable and aggregate them, these utility changes need to be measured in common units. Therefore, a researcher has to define a so-called numéraire that measures the worth of all commodities in a single unit. In principle, any good an individual is willing to give up for having the environmental improvement in question could be employed as numéraire (see Freeman, 2003: 12). However, employing monetary units to measure environmental values has several advantages. For example, to account for the golden rule that the payment scenario should resemble a real market situation as closely as possible, asking respondents to express their WTP in terms of money lies at hand. Furthermore, in view of cost-benefit assessments, it makes obviously sense to assess WTP directly in terms of money rather than assessing it in some alternative unit that needs to be translated into monetary units subsequent to the data collection. However, asking people to translate the benefit they expect to experience due to an environmental improvement into monetary units is problematic when the CVM survey is conducted in very poor countries where household budgets are so tight that people are not able to express their appreciation of an environmental project in terms of a monetary contribution (c.f. Ahlheim et al., 2010b). Analogously, attitudes towards spending money may be critical for a respondent's willingness and ability to express his or her appreciation of an environmental project in monetary units. Given that the CVM survey is perceived as realistic and the payment rule as consequential, it is expected that a person's general money spending disposition matters for his or her answer to questions concerning a monetary contribution to an environmental good. Again, the WTP statements of people who tend to refuse to give up money for anything appear to be a case which is worth

investigation. Similarly to people who are obviously poor, misers are likely to more frequently state a zero WTP than other respondents, even if their utility increases due to the environmental improvement in question.

In the CVM literature some attention has been paid to the use of alternative, non-monetary numéraires. A number of CVM studies employed labour as the unit in which respondents had to make their value statements ('willingness to work', cf. e.g. Vondolia et al., 2014, Hung et al., 2007, Swallow and Woudyalew, 1994, Echessah et al., 1997). These studies were conducted in developing countries and used a split sample design to compare the effect of a money numéraire and a labour numéraire on WTP. A common finding is that mean WTP for the same environmental good is higher when expressed in terms of labour as compared to mean WTP expressed in terms of money. Furthermore, these studies reported that the labour numéraire was usually better accepted by the respondents than the money numéraire. However, Ahlheim et al. (2010b) showed theoretically and empirically that the willingness to work concept is seriously flawed. The study points to the difficulties related to converting hours of labour into utility. Bergstrom et al. (2004) investigated whether tax reallocations represent an alternative to money payments when valuing environmental projects. In an exemplary CVM survey on groundwater quality a bundle of 'all other public goods' was used as numéraire. Respondents were asked whether they would support an environmental project given that the level of provision of all public goods provided by the government would decrease. The authors highlighted several problems related to asking the elicitation question in this way. The public goods numéraire may be understood differently and loosely interpreted by respondents; some might think of a broad set of publicly provided goods and services, others may focus exclusively on one particular public good. Bergstrom et al. (2004) concluded that the use of tax reallocation in CVM studies should proceed with caution. Thus, there is nowadays no satisfying alternative to the assessment of WTP in monetary units. This means that the 'numéraire effect' needs to be tackled by indirect methods, for example by employing follow-up questions concerning a respondent's financial situation, ethical concerns about trading money against environmental quality and a person's money spending habits.

Enhancing the quality of CVM surveys by means of participatory approaches

Looking at the long but not even complete list of biases and other sources of errors which threaten the reliability and validity of stated WTP presented in this section it becomes clear that a CVM survey requires careful preparation and diligent analysis. Besides consultation of experts and pilot studies to test out the questionnaire, participatory approaches are a good method to increase the quality of the survey. The primary references for the practical conduct of CVM surveys (Bateman et al., 2002, Carson and Hanemann, 2005, Arrow and Solow, 1993) all recommend using participatory approaches when preparing a CVM survey. The most prominent example is the employment of **focus groups** (see Bateman et al., 2002: 153). A focus group is a small group of individuals, in many cases students, who discuss questions related to the survey design with a moderator during a meeting that runs approximately 90 minutes. In the context of CVM, focus groups are typically consulted at an early stage of the survey design. When discussing with

focus groups, researchers can gain useful information regarding, for example, the informational components and the payment scenario of the questionnaire. Subsequent to a focus group meeting, the questionnaire should be revised based on the comments and suggestions made by the participants.

Another promising possibility to enhance a CVM survey's quality consists of consulting so-called citizen experts at several stages of the study (c.f. Ahlheim et al., 2010a). **Citizen expert groups** (CEGs) consist of ten to twelve citizens, i.e. common people without a particular scientific or political background. Ideally, the group includes individuals with different socio-demographic characteristics so that the population to be surveyed is adequately represented by the CEG. Unlike focus groups, which researchers consult only once, typically at the very beginning of the survey preparation, citizen experts are invited several times during the research phase (cf. Figure 2-1).

During the different CEG meetings they learn about the theoretical background of CVM studies, gain insights into the environmental project to be evaluated and help the researcher to develop a suitable, coherent questionnaire as well as to interpret preliminary and final results. The contributions of citizens, in addition to expert knowledge and experience gained from pilot surveys, have turned out as very valuable. The discussions and interaction with citizen experts are particularly enlightening when it comes to questions concerning the comprehensibility of the questionnaire, the wording of text passages and questions, and the avoidance of sensitive topics. Several issues potentially affecting the validity of results can be addressed during CEG meetings, including the optimal amount of information that should be provided to the respondents, the choice of the payment vehicle and the elicitation format, the perceived relevance of the survey as well as resentments within the society that might provoke protest responses. Furthermore, all kinds of auxiliary questions can be discussed with the CEG. These questions typically address attitudes, personality traits, norms and values and hence culturally specific facets of life. Inventories aimed to measure, for example, environmental attitudes or certain personality traits typically stem from western countries. In many cases these inventories have to be translated and potentially also adapted to the specific social and cultural context of the study site. Assessing money attitudes in the context of a CVM survey is a good example for these issues. Frequently used money attitude inventories, such as Furnham's (1984) 'Money Beliefs and Behaviour Scale', have been developed in English-speaking western countries and there is little experience regarding their performance in other cultural and social contexts. Like any other attitude, people's disposition to spend money in general is culturally specific and socially constructed. Questions regarding, for example, spending and saving habits, may be misperceived or misunderstood by the members of societies with substantially different values and norms than western societies. For this reason, auxiliary questions, especially those addressing culturally sensitive issues, should be carefully discussed with the CEG before the data collection starts. Likewise, preliminary and final survey results, for example the plausibility of the distribution of answers to a particular attitudinal question, can be addressed during a CEG meeting.

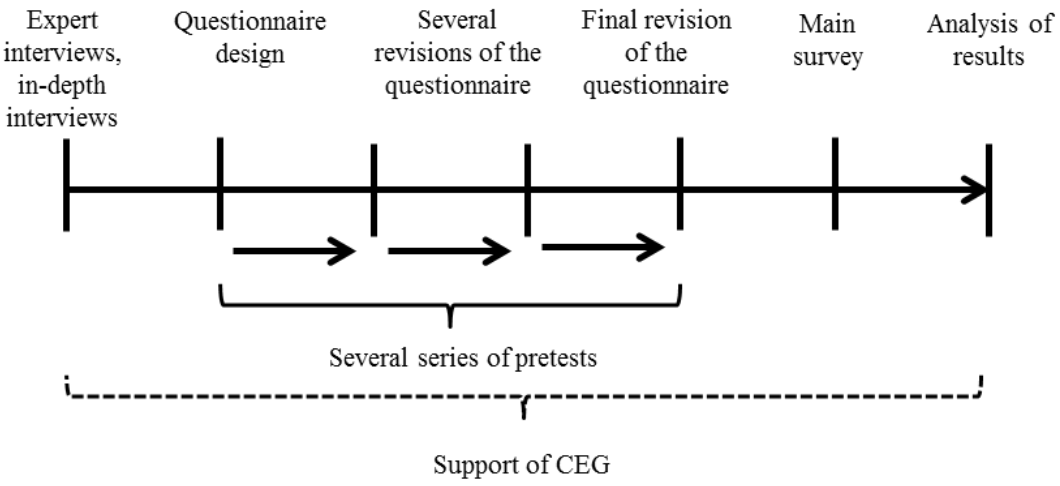

Figure 2-1: Involvement of Citizen Expert Groups at several stages of CVM studies

(adapted from Ahlheim, 2014)

Summary of chapter 2

This chapter gave a general introduction to environmental valuation. Apart from a brief summary of the usefulness and the objectives of environmental valuation studies, several methods that practitioners apply to assess the monetary value of environmental goods were presented. Among these methods, Contingent Valuation is a particularly suitable technique for the assessment of the benefits of prospective environmental projects. Since CVM is also the valuation technique employed in the empirical part of this dissertation, the theoretical and practical aspects of this method were in the focus of the remaining chapter. In spite of its theoretical soundness and its widespread use, CVM is controversially discussed in economic literature. Critics doubt that CVM surveys provide accurate measures of the true economic value of environmental goods. In view of the long list of biases that analysts have repeatedly identified in CVM studies, it is quite understandable that sceptical attitudes towards survey-based environmental valuation studies are so widespread. At the same time, and in contrast to other environmental valuation methods, these biases are well-understood and analysts are generally aware of the multiple aspects which may threaten the validity of survey-based WTP estimates. Hence, it is in the best interest of a CVM practitioner to carefully prepare the survey, to implement it diligently and to attentively analyse the collected data.

As highlighted in the last section of this chapter, it is hardly possible to eliminate all sources of error and bias when conducting a CVM survey. For example, even though this is likely to affect the validity of the value statements of at least some respondents, utility gains accruing from environmental improvements have to be assessed in monetary units. This is because nowadays no suitable alternative exists; willingness-to-work, in-kind payments and other potential alternatives have turned out to cause even more issues than standard payment intentions. Criticism addressed towards assessing the value people attribute to environmental changes in terms of money

mainly incorporates two arguments. There is concern that poor respondents are not able to make meaningful WTP statements because of their tight budget. The other aspect addresses some people's objection of putting monetary values on environmental goods because they believe that these goods have an immeasurable value that should not be monetised. A similar but so far overlooked topic is the presence of misers in a sample, i.e. people who hate spending money in general and limit their expenditures to an absolute minimum, although they have no obvious reason for doing so. As argued at the end of this chapter, such money retention is likely to be a useful predictor for WTP statements. A careful theoretical and empirical analysis of this psychological variable is promising, especially in view of the possibility that the WTP statements of misers are meaningless and threaten the validity of the overall survey outcome.

Before analysing the role of ill-founded attitudes towards spending money in the particular context of CVM, the role of money and miserliness shall be explored in a broader scientific context. The focus of the next chapter therefore lies on the role of money in economics.

3 Money in economics

Money is one of the most widely investigated topics in economics. The origin of money, the advantages of monetary economies over barter systems, people's demand for money, its optimal supply by the money issuing authority and many other money-related questions have been analysed by economists for centuries. There are also multiple ongoing controversies in monetary economics, for example the diverging views of Keynesians economists on the one hand and Monetarists on the other, regarding the optimal conduct of monetary policy. In spite of such heated debates between economic schools, there are also a number of facts on which a vast majority of economists would agree, regardless of their economic tradition. For example, a chapter on money in an economic textbook typically starts by defining money as a medium of exchange, which is used to make payments in the economy. Regardless of the form it takes (coins, notes, bank cards, cheques or some positive number on one's bank statement), people never desire money for its own sake but merely for the goods and services it can buy. Rational individuals do not derive utility from the possession of money; they only gain satisfaction when converting their financial resources into consumption, according to the neoclassical framework. Like many of the assumptions that economists employ in their theories and models, the empirical accuracy of this neutrality postulate can be questioned. Although the members of contemporary societies are mostly aware of the fact that not money as such but its ability to purchase practically everything is what makes money desirable, strange monetary patterns exist. For example, rather than spending their money on the things they desire or investing it into profitable assets to build up a reserve for future needs and risks, some people appear to be extraordinarily stingy. The existence of misers, i.e. people who are extremely reluctant to spend even though they have no obvious reason for doing so, is sometimes mentioned in economic literature (cf. e.g. Niehans, 1978: 14, Keynes, [1936] 2009: 108). However, in most cases, researchers consider this phenomenon as too rare to be accounted for. Even in behavioural economics, the more recent branch of economics which deals with all kinds or irregularities and irrationalities in economic behaviour, miserliness has attracted little attention.

The objective of this chapter is twofold: Firstly, it recaptures the standard approach regarding the role of money in economics. Secondly, the chapter also introduces some alternatives views regarding people's preferences for possessing money and the way in which money affects economic decisions like spending and saving. Naturally, the economic literature on money is by far too broad to be fully covered in this chapter. The following sections provide some insights of, for this dissertation relevant, money-related topics in economics. These topics – namely the history of money (section 3.1), money in micro- and macroeconomics (section 3.2) as well as the contributions of some behavioural economists (section 3.3) – illustrate quite well how popular the neutrality postulate actually is across different economic branches. At the same time, it will become apparent that alternative views with regard to the aforementioned aspects exist while questioning the neutrality postulate.

3.1 The economic history of money

In modern economies, money takes the role of a medium of exchange, which is used for all kinds of payments. Money can take different forms and the objects that have served as media of exchange have changed over time. A common characteristic of the objects which serve as money in contemporary economies – coins, notes or bank cards, for example – is that they have hardly any material value. The only reason why people accept money as a means of payment is their knowledge about the possibility of exchanging this money for all kinds of commodities they desire. A question which has occupied economists for centuries is how it came to this general acceptance of coins, notes and other means of payment of hardly any intrinsic value.

When opening an economic textbook on money, a reader typically encounters an introductory chapter where the 'history of money' and the 'functions' which money fulfils in modern economies are described (cf. e.g. Samuelson and Nordhaus, 2001: 511-513). The most popular approach to explain why and how money came into the economy can be traced back to Aristotle (cf. Gerloff, 1947, Meikle, 2000). According to the Greek philosopher, the origin of money lies in the drawbacks of a barter system in which goods have to be directly exchanged for goods. Economists explaining the origins of modern money frequently adapted this idea. Following the standard approach to introduce a chapter on money in economics, this section also rewrites the emergence of money as a medium of exchange. Naturally, the corresponding description is not meant to be historically accurate. The textbook-barter economy, which gives birth to money, has probably never existed and severe criticism has been addressed towards the traditional explanation of money's origins which economists have been propagating for centuries (c.f. e.g. Innes, 1913, Innes, 1914, Knapp, 1924, Wray, 2014, Wray, 2004). However, the conjectural history of money which was firstly told by Aristotle, adapted by Hume (1742) and Smith ([1776] 2007) and revitalised at the end of the nineteenth century by Menger (1892) and Jevons (1896) can be considered as a 'useful myth' (Dowd, 2000: 139) because the origin of money becomes firmly grounded in its most important economic function, namely its roles as a medium of exchange. Even though one may question whether the exchange theory contributes to a better understanding of the functioning of real markets, this theory definitely helps to grasp the role which money plays in neoclassical economic theory.

3.1.1 From primitive barter…

Advocates of the medium of exchange theory propose that people lived in small self-sufficient clans in early societies. In this model-like world each clan produces basic goods like food and clothes and does not depend on the supply of goods by any other entity. Over time, people discover the benefits of exchanging goods produced by their own clan against goods produced by other groups, for example because the latter are different or superior in their quality. Thus, the members of one clan take interest in exchanging goods with the members of another clan and start bartering. This form of primitive exchange progressively spreads and people become specialised in the production of certain goods; they produce articles in excess of their needs in an

attempt to exchange them for a more desirable combination of goods. With increasing levels of specialisation, individuals become gradually independent from their own clan but increasingly dependent on bartering to convert their self-made goods. However, they will face a number of problems due to the drawbacks of the direct barter system (cf. Jevons, 1896: 3-7). Most importantly, finding a suitable trading partner can be extremely difficult in money-less economies. The chance that an individual A meets an individual B who offers the object that A desires and at the same time wants the product offered by A rarely happens in a pure barter system. As a consequence, only a very narrow number of bargains can be concluded. To overcome this problem of the 'double coincidence' (Jevons, 1896: 8) of wants, trading partners start, by convention or by habit, to accept intermediate objects in exchange for their self-produced goods in a first act of exchange. In a later act of exchange, they exchange this intermediate object against the commodity they ultimately desire. At the beginning of this development, multiple media of exchange coexist. However, certain commodities, for example precious metals, turn out to be more suitable as media of exchange than other goods and in the end there will only be one single medium of exchange which is used by all sellers and buyers. Similar to modern economies, the reason for accepting, for example, a silver bar in exchange for some other product is no longer rooted exclusively in its usefulness as a consumption good but mainly results form a seller's knowledge that other people will accept it as a means of payment.

A second drawback of a barter economy consists of the extensive information and time needed to conclude a bargain. In a pure barter system, the two trading partners have to agree on the exchange ratio of the commodities in question. Some individuals will publish lists with the exchange ratios for all single commodities they are willing to accept in exchange for the goods they offer. In the absence of a yardstick in which the value of each single commodity can be expressed, such price lists are likely to become extensively long. However, the information and time needed to agree on the rate at which bargains are concluded shrinks when people agree on a common measure of value (a unit of account). The total number of exchange ratio and thus the length of any price list are narrowed down substantially when all exchange ratios are expressed in terms of a common denominator. Although the units of any commodity could be used for this purpose, it appears convenient to express all prices in terms of the units of the substance which is used to effectuate all kinds of payment. As highlighted by Jevons (1896), it saves trouble when prices are quoted and calculated in terms of the object which also serves as a means of payment.

An important difference between a pure barter system and an economy where one commodity has emerged as a generally accepted medium of exchange is that exchange is subdivided into two different acts, namely selling and buying. Unlike in a barter system, these two acts do not take place simultaneously and are often performed at different places and points in time. To become commonly accepted by the sellers, the medium of exchange must not lose value during the period between its sale and purchase. The generally accepted medium of exchange, which at the same time provides the unit in which all prices are cited, must also be a general form in which wealth can be stored.

3.1.2 … to monetary exchange

In economics, money is defined as the object which simultaneously fulfils the function of a medium of exchange and a store of value while providing the unit of account. This implies that the term money is used to describe two different things. On the one hand, money is the name of the object which circulates as a medium of exchange and which is at the same time an asset in which wealth can be stored. On the other hand, the term money refers to a more abstract concept: the measurement unit in which prices are quoted and economic variables like income, wealth or debts are expressed. Naturally, this somewhat ambiguous use of language is not limited to economics but can also be found in other social sciences and, of course, in everyday language. For example, people use 'money' as a synonym for income and wealth because both variables are measureable in terms of the units of the money-object that circulates in an economy.

With the introduction of money as a medium of exchange that, ideally, does not lose value over time, it becomes notably easier to store purchasing power for later periods of life. People can easily delay consumption by saving part of their income, i.e. the money obtained in exchange for self-made products or labour. Economists often refer to the store of value function to explain why in the past certain commodities were more likely to be used as money than others. First of all, the object which emerges as money should be durable and stable in value. A perishable good like meat needs to be consumed immediately and its value diminishes with every additional day of storage. Other goods perform much better on these criteria. Precious metals, in particular, are durable, easy to store and their value does not greatly change over time. Furthermore, proponents of the medium of exchange theory explain the predominant role of precious metals in monetary history by several characteristics, which arise from money's medium of exchange function. According to Menger (1892), the key determinant for a good to become a medium of exchange is its saleability, i.e. how easy it is to dispose of that good on the market. Even before traders started to employ precious metals as media of exchange, the members of most early societies highly desired these objects, among other things because of their beauty and usefulness for the fabrication of jewellery, weapons and tools. The value of precious metals has always been high in relation to their weight so that people faced rather low costs when carrying precious metals to the market place. According to the exchange theoretical theory, precious metals have emerged as money because of their durability, storability, stability in value, portability and their high intrinsic value.

Although the use of precious metals as media of exchange constitutes an important progress compared to a barter system, there is still room for increasing the efficiency of the economy. Exchange is complicated by the fact that traders have to assess the weight and the purity of the precious metal in use before realising a transaction. To overcome this inconvenience, some traders start to transform the metal bars into standardised metal pieces like rings or bars. The value of these pieces is more readily identifiable and time-consuming procedures like weighing becomes superfluous. Mints, specialised in the production of coins of standardised weight and fineness, start to develop (see Dowd, 2000: 144).

The next important step in the history of money is the development of paper money. Since many people possess more gold or coins than they immediately need for their purchases, they have to store them. Some individuals will accept to store other people's money. Those who have the capacity of treasuring coins or precious metals, for example goldsmiths, typically offer this service (see Lipsey, 2007: 447). In exchange for the obtained coin deposit they hand out a receipt indicating their obligation towards the depositor. People quickly recognise that carrying around light paper receipts instead of heavy metal coins further facilitates the act of buying and selling. Thus, the paper receipts start to circulate as means of payment. Occasionally a depositor asks for the coins he or she has stored at the goldsmith's safe. In many cases, however, the paper receipts merely pass from one person to another and the goldsmiths recognise how unlikely it is that all depositors would request to convert their receipts into coins at the same time. Thus, similar to modern banks, goldsmiths start to lend out money against interest payments. To increase their profits, they issue a total of receipts which is higher than the amount of coins on deposit (c.f. Dowd, 2000: 144-145). This early form of fractional reserve banking causes a major problem, namely that many different kinds of banknotes circulate. Hence, with the development of banks the monetised economy loses again one of its main advantages over a barter system. There are multiple kinds of money which unnecessarily complicate the accounting system. In addition to that, uncontrolled fractional reserve banking often leads to an oversupply of money causing inflation and bank runs. As a consequence, the state monopolises part of the banking system; coins and notes are only issued by the government-owned central bank from this point on (see Lipsey, 2007: 448).

The resource costs of money decrease throughout the conjectural stages of its development. In early stages, when commodities like gold or silver barren circulate, these costs are substantial. They get lower with the invention of coins with higher face value than metal value and converge to zero with the emergence of paper money. However, until recently, the coins and paper money issued by most monetary authorities in the world were convertible into gold or some other external standard of value, which the issuing authority had to keep as a reserve. An ultimate efficiency gain that has been realised in practically all industrialised countries is the abolishment of money's convertibility into anything else. The contemporary monetary system is one of claims like coins, notes and bank deposits which have no fixed value in terms of any external standard. Modern money is merely backed by governments' promise that all bills can be paid with it.

Since the medium of exchange function of modern money is so central and tangible in contemporary economies, it comes as little surprise that theorists have paid so much attention to money's role as a medium of exchange. The exchange-theoretical explanation of money's origins is certainly one of the reasons why neoclassical economists, including micro- and the macroeconomic branches, treat money merely as some neutral means of payment and never as a desirable commodity.

3.2 Money in micro- and macroeconomics

3.2.1 Money in consumer theory

Historical evidence backs the theory that money enhances the efficiency of the economy. It facilitates exchange and it presses ahead with specialisation. From an individual's perspective, the existence of money is particularly beneficial because it makes accounting processes much easier as compared to a barter system. For example, the innumerable cost-benefit considerations consumers have to make in purchasing situations would be extremely complicated if there were no money prices which provide information about the cost and the value of the commodities at choice. However, relative to its great significance in everyday life, money only plays a minor role in microeconomic theory. This does not mean that money is completely absent in the theories and models used to describe and predict the market behaviour of individual consumers. Income and price, which are two of the key variables in consumer theory, are typically expressed in dollars, euros or any other monetary unit. However, the existence of monetary units and some medium of exchange in which individuals are paid out their wage or salary does not affect individual consumption choices; the optimal solution of the consumer's utility maximisation problem in a money-less world with exchange ratios and incomes expressed in units of labour is identical to an economy with money prices and money incomes (see e.g. Richter, 1990: chapter 1). According to the theory, a rational consumer will opt for allocating his or her income in a way that the marginal rate of substitution equals the price ratio. Since all prices are expressed in terms of the units of a numéraire good, these units simply cancel out in the optimum (ibid.). Hence, at the theoretical level, it does not matter whether money, a particular consumption good or a composite commodity is employed as numéraire.

Since neoclassical theory postulates that a consumer desires exactly the same goods in a monetised economy as in a barter system, money cannot appear in a consumer's preference ordering. According to the standard assumptions, individuals have well-ordered preferences over consumption goods and they are able to rank these goods, i.e. they know what they like best, what they like least and which goods or bundles of goods they enjoy equally. However, money never appears among the genuine consumption goods which make up the preference ordering. This is because in neoclassical economics the money-object which is used to effectuate payments is defined as nothing more than a neutral medium of exchange. A certain amount of money represents the worth of the different combinations of commodities which consumers can buy with this amount of money. As highlighted more than 200 years ago by Adam Smith, 'Goods can serve many other purposes besides purchasing money, but money can serve no other purpose besides purchasing goods. (…) It is not for its own sake that men desire money, but for the sake of what they can purchase with it' (Smith, [1776] 2007: 282). It is also worth noticing that, as highlighted by Niehans (1978), integrating money into the preference ordering poses technical problems. This is because preferences are defined independently of the price system in the standard model. This is to say that individuals are able to compare and rank alternative bundles of goods without

knowing the market prices of the goods in question. However, deciding whether a certain amount of money is better, worse or as good as some commodity in terms of utility is impossible as long as the price system is unknown. Since the value of a bank note is exclusively determined by the amount of commodities it can buy, people need to have some idea about the prices at which the commodities they desire are sold.

In microeconomic theory, an individual's consumption choices are constraint by his or her budget. The higher an individual's income is, the more desired things he or she can purchase; using everyday language, the more money, the better. There is a positive relationship between money and utility because utility is an increasing function of consumption and because a higher income enables the individual to consume more. Nevertheless, income as such does not generate utility; individuals gain utility only after they have exchanged their income for goods or services. To make this proposition clearer, let us think of two individuals with identical preferences and tastes. One of them disposes of a monthly income of €1,000 and spends this amount completely on the goods and services he likes. The other one earns €1,200, puts €200 into her piggy bank and spends the remaining money. At the end of a month these two individuals are equally well off, they reach the same level of utility, although one of them has a higher income than the other. The utility level of the 'richer' individual would only exceed the utility of the other one if she had spent the extra €200.

Another important proposition in neoclassical consumer theory is the absence of money illusion. As argued in macroeconomics, an increase in the quantity of money will lead to a proportional increase in prices and incomes, at least in the long run (cf. section 3.2.2). In microeconomics, rational consumers are assumed to take account of this relationship. An individual 'knows' that if his or her nominal wage rate increases, prices will increase by the same proportion. By contrast, money illusion would be at work if individuals believed that an increase of their nominal income alters their purchasing power even though prices increase to a greater extent than nominal income has increased. According to neoclassical microeconomic theory, a consumer's demand schedule and real expenditures depend only on relative prices and relative income. Demand and real expenditures are unaffected by the absolute price level and the nominal amount of money people obtain as income. Mathematically, the absence of money illusion is formalised by the homogeneity postulate. The utility function is homogenous of degree zero in prices and income which means that proportional changes in these nominal variables do not affect the utility level (cf. Jehle and Reny, 2011).

Hence, in the standard model of consumer choice money takes the role of a medium of exchange without intrinsic value and as a medium of account in which prices and income are expressed. Unsurprisingly, there is no space for the third defining function of money in the single-period case that has been considered in the previous paragraphs; money does not take the role of a store of value in the basic model. A rational consumer would never wish to store part of his or her income as long as there is no future period in which the money put aside could be used up for consumption. This assumption is, of course, not fully maintained in life-cycle theory which ex-

plains an individual's consumption and saving decisions in multiple periods. However, maintaining the neutrality postulate, economists typically define the act of saving in terms of future consumption, for example as 'the accumulation of assets for future use' (Lord, 2002: 1). There are several assets an individual can use for this purpose and money in the form of cash or saving deposits is one of them. Just as in the standard model described above, satisfaction merely accrues from the act of consuming. Financial assets, including money, only yield utility when individuals deplete them to purchase things which yield genuine satisfaction. Life-cycle theory offers several explanations why people put aside part of their money income rather than depleting it completely in a particular period of time. In economics, the most prominent motive for saving is preparing for retirement. Furthermore, uncertainty about future income, future needs or the age at death as well as general precaution and bequest motives belong to the key determinants for people's saving decisions. In any of these cases, the accumulation of financial assets is never an end in itself but a means to enhance one's (or one's heirs) future consumption possibilities. Taken together, the neutrality postulate regarding people's desire for money is paramount in microeconomic theory.

3.2.2 Money demand theory

The coins and notes circulating in contemporary markets have hardly any intrinsic value. Nevertheless, people use and accept these at first glance useless tokens as means of payment. The reason for doing so is rooted in everybody's belief that one can use this money for future transactions. However, this system can only work if the purchasing power of money remains stable over time. People believe that the value of a euro, in terms of the commodities it can buy, remains approximately the same, regardless of whether the euro is used as a means of payment now or a few days later. If this was not the case people would be more hesitant in selling their labour or products for some worthless pieces of paper or metal. Hence, one of the central tasks of the money issuing authority consists of keeping the value of money stable by controlling the quantity of money in circulation.

Ideally, the supply of money just satisfies the aggregate demand for money. Hence, from the macroeconomic perspective, it is of great importance to understand the factors which affect the demand for money in order to predict how changes in the quantity of money affect economic activity. The amount of money that everyone in the economy wishes to hold depends in first place on the total volume of transactions made in an economy; the more transactions are made the more money is needed. Furthermore, knowledge about the speed at which money circulates, the so-called velocity of money, is of central importance for the success of monetary policy. The latter variable depends on technical factors like a society's payment habits as well as on people's liquidity preference, i.e. their subjective desire to keep certain amounts of money in their wallets or bank accounts. Traditionally, there has been a lot of disagreement among different economic schools regarding the main determinants of people's liquidity preference resulting in partly different demand for money theories. This section introduces the most popular among the many macroeconomic money demand theories. Furthermore, the concepts of money employed by John

Maynard Keynes and Milton Friedman, two twentieth century economists who extensively wrote about money and whose names may be most closely associated with monetary theory, will be discussed at the end of this section.

The demand for money: From classical quantity theory to Friedman's 'restatement'

For a long time, economists were hardly interested in analysing the demand for money. Adam Smith, Jean-Baptiste Say, David Ricardo and other Classical theorists strictly considered money as a medium of exchange. From this perspective, people cannot desire money for its own sake and it suffices to analyse money as a token which facilitates transactions. In the classical theory, households are assumed to hold no more than the amount of money they plan to spend in the period between the days on which they receive their wage or salary. The quantity of money circulating in an economy affects neither relative prices nor real output. Changes in its quantity only affect the overall price level but leave any real variable (employment, production, real income, etc.) unaffected. The so-called quantity equation, a simple tautology first formulated by Fisher ([1911] 1997), formalises this relationship. The famous equation **MV=YP** simply displays the Classical economists' proposition that the stock of money (M) is determined by the speed at which money is spent (the velocity of money, V), the level of current output (Y) which determines the total number of transactions involved in exchange, and the price level (P). The Classics considered the velocity V as being determined by mainly technological factors, for example a country's banking system, the frequency of receipts and payments as well as the length of payment periods. Therefore, they assumed V to be roughly constant (see Hosek and Zahn, 1977: 107). Furthermore, the Classics considered output Y as independent from the quantity of money.[5] Accordingly, a change in the quantity of money can only affect the overall price level but has no lasting effect on neither real output nor real income in the classical theory. In other words, money is neutral with respect to the amount and the distribution of real income, but the Classics viewed increases in its quantity as one of the most important reasons for inflation (cf. Crockett, 1981: 47-50).

Since the Classics assumed money to be merely wanted for the things it can buy and because they proposed that the amount of money people wish to hold relative to their income depends mainly on institutional factors which hardly change in the short run, it was relatively straightforward to determine the optimal supply of money. It sufficed to assess the transaction demand, i.e. the demand for money to be spent. Hence, the aggregate demand for money M^D varies directly and proportionally with the price level; this relationship is formally expressed as

$$M^D = P \cdot (Y/V), \tag{3-1}$$

where Y/V is a technically determined factor of proportionality.

[5] The independence of output Y and the quantity of money M is a result of the full employment assumption made by the Classics. Market forces were assumed to bring the economy back to the state of equilibrium whenever resources were unemployed or goods left unsold.

In the 1930s, a group of Cambridge economists headed by Marshall (1927) suggested that not only the function of money as a medium of exchange but also its role as a store of value should be taken into account to correctly determine the aggregate demand for money. Marshall and colleagues viewed money as a temporary abode of purchasing power, a concept which Friedman (1956) adopted three decades later, too. They treated money as any other asset and modelled its demand in terms of individual choices and decisions. Hence, the Cambridge economists made an attempt to reformulate the classical quantity equation. However, the new version differed only in terms of the conception of the velocity of money as compared to the traditional quantity equation. They considered the proportion of income people desire to hold in the form of money as being determined by the transactions people plan to realise in a particular period and also by people's subjective desire to store part of their wealth in the liquid form. Formally, the demand for money is determined by the desired ratio of cash balances to income labelled by the letter k (the 'Cambridge k'), the level of current output and the price level:

$$M^D = kPY. \tag{3-2}$$

The Cambridge economists already recognised that the money holding coefficient k was more than just a technical factor but determined by individual preferences and expectations about the returns of non-monetary assets which are likely to change over time. Nevertheless, the Cambridge economists still assumed k to be roughly constant. Accordingly, the traditional assumption regarding the proportional relationship between the price level and the quantity of money demanded was maintained (cf. Hosek and Zahn, 1977).

Keynes' liquidity preference theory, exposed in the *General Theory* (GT Keynes, [1936] 2009), importantly draws from the Cambridge approach but also extends it. While the Cambridge economists had focussed on analysing the effects of changes in income on the demand of money, Keynes extended their approach by also accounting for changes in the interest rate and expectations about such changes when analysing the demand for money. He emphasised that there are multiple factors which explain why individuals refrain from spending their income and why they opt for holding part of their wealth in the form of money. The three driving motives for holding money are, according to Keynes ([1936] 2009: 170), '(i) the transactions-motive, i.e. the need of cash for the current transaction of personal or business exchanges; (ii) the precautionary-motive, i.e. the desire for security as to the future cash equivalent of a certain proportion of total resources; and (iii) the speculative-motive, i.e. the object of securing profit from knowing better than the market what the future will bring forth.'

The transaction demand for money (i) closely resembles the Cambridge variant of the demand for money theory. Money is held as an abode for purchasing power to facilitate planned and foreseeable transactions. It is determined by the price level and an individual's income. Keynes ([1936] 2009) suggested that the precautionary demand for money, which takes the role of a reserve for uncertain emergencies or opportunities, was positively related to an individual's income level, too. In later applications, researchers often lumped the transaction demand and the precautionary demand together (M^{DT}), because, in the end, both represent a desire for money as a

medium of exchange which is influenced overall by the same factors, namely income and the price level. While the first two components of the demand for money appear to be mostly adopted from the Cambridge school, Keynes' ([1939] 2009) main innovation was the speculative demand for money (M^{DS}). One can think of speculative cash balances as a piggy bank into which an individual may or may not put his or her money in surplus, i.e. money which people do not use to satisfy their transaction or precautionary needs. The latter decision is determined by an individual's expectations about the return of other financial assets, the latter being related to the future interest rate on these assets. Keynes ([1936] 2009) merely considered two alternative assets, namely cash and interest-bearing bonds. People hold money to avoid capital losses on bonds; or they invest their money into bonds in order to profit from capital gains on bonds. He theorised that the demand for bonds would increase with the interest rate. According to this theory, the probability that an individual empties the piggy bank and buys bonds is high when the current interest rate is high; therefore, the overall demand for speculative balances is low in the case of a high current interest rate. When the current interest rate is low the probability that an individual sells bonds and holds money is high; thus, the overall demand for speculative balances is high in the case of a low current interest rate. Finally, in the case of a very low current interest rate everybody hoards money in his or her piggy bank. According to Keynes ([1936] 2009), there is absolute liquidity preference in such a situation and the economy is in the 'liquidity trap', which means that an increase in the quantity of money has no effect on the economy's activity. As expressed by equation 3-3, the overall demand for money is

$$M^D = M^{DT} + M^{DS} = kYP + f(r), \tag{3-3}$$

where r is the market rate of interest based on which individuals form their expectations about the future interest rate (cf. Hosek and Zahn, 1977: 111). The demand for money thus proportionally increases with income (which determines the demand for money for transaction purposes) and varies inversely with the interest rate (which determines the attractiveness of money as a store of value as compared to non-monetary assets). It is to be noted that the market interest rate does not only become a key variable in the demand for money function but that it is also conceptualised differently by Keynes ([1936] 2009) than by his predecessors. While the Classics considered the interest rate as encouraging individuals to forgo present consumption, Keynes ([1936] 2009) viewed interest income as a 'reward of not-hoarding', i.e. as a compensation for parting with liquidity by storing one's wealth in less liquid assets than money. Furthermore, the proportion of income people wish to hold in the form of money becomes difficult to predict in the Keynesian world. It depends on multiple factors, including highly subjective, and hence hardly measurable, expectations about the future interest rate. Since the velocity of money is, according to Keynes ([1936] 2009) and his followers, neither constant nor stable, changes in the quantity of money have no predictable effects on the price level and real variables like real income, employment and the output of the economy (cf. Doppmann-Handschin, 1989: 135-137). An increase in the quantity of money does not necessarily translate into a proportional increase in prices, at least not in the short run, according to the Keynesian point of view. In contrast to the

Classical perspective, an increase in the quantity of money may lower unemployment and increase real income. In that sense, money is not neutral in the Keynesian world (see e.g. Makinen, 1981: 421-454 for a summary of the effects of money and monetary policy in the Keynesian theory of money). Last but not least, the traditional argument that money is never desired for its own sake does not hold under certain circumstances. The demand for money as a store of wealth may even become insatiable in the case of a very low interest rate, according to Keynes' ([1936] 2009) reasoning.

Subsequent to its publication in the *General Theory* the liquidity theory was heavily criticised. The major criticism was directed towards the somewhat artificial separation between different money holding motives, the consideration of merely two assets (bonds and money), the neglect of additional variables potentially affecting the demand of money like people's degree of risk aversion, their expectations about future inflation rates and the question as to whether people's overall wealth rather than their current income is the relevant predictor variable for their transaction demand and precautionary demand for money. Several economists attempted to refine and formalise Keynes' money demand theory. Hicks (1935), for example, treated the demand for money as a problem of asset choice and analysed it within the conventional rational choice framework. Tobin (1958) notably refined Keynes' ([1936] 2009) framework on the speculative demand for money. To account for the criticism towards the demand for money function formulated in the *General Theory*, the Keynesian economists extended the set of explanatory variables in the money demand equation. At the same time, they maintained the questionable dichotomisation of the demand for money into a transaction and a speculative demand. Furthermore, the 'liquidity trap' hypothesis, i.e. the situation where the market interest rate is extremely low and people get an insatiable appetite to accumulate cash, turned out to be at odds with empirical data (cf. Bronfenbrenner and Mayer, 1960, Laidler, 1966).

Modern theoretical and empirical work on the demand for money is based on Friedman's (1956) 'restatement' of quantity theory (I will refer to this theory as 'neo-quantity theory' in the following paragraphs). Similar to Hicks (1935), Friedman treated the demand for money as a problem of asset choice. In contrast to the Keynesian theorists, however, he did not separate the demand for money into distinctive motives. In neo-quantity theory, money takes the role of a temporary abode of purchasing power, i.e. an asset which is used as a store of wealth but designated to be spent, a definition which combines money's medium exchange and store of value function. As compared to Keynes, the proponents of neo-quantity theory consider a broader set of variables when explaining the demand of money, including the interest rates on other financial assets, the interest rate on the capital market, the rate of return on equities and individual preferences over the non-pecuniary advantage of holding money. These non-pecuniary benefits encompass, among other things, the convenience of not having to spend time and resources on converting non-money assets back into cash; the advantages of being liquid when there is a good opportunity to make a good bargain; and a feeling of safety resulting from having part of one's wealth stored in an asset with a certain and riskless nominal return. The concept of non-

pecuniary benefits resembles the concept of liquidity preference introduced by Keynes. The factors determining a society's taste for money include, for example, people's expectations about the future economic development. At an aggregate level, liquidity preference is particularly high in times when many members of a society have pessimistic expectations about their future incomes and rather low when expectations are, on average, optimistic (this idea can be found in Friedman, 1961). However, since this taste parameter is difficult to measure, macroeconomists typically opt for putting it aside from their analysis (see Lewis and Mizen, 2000: 158).

According to the proponents of neo-quantity theory, people's total wealth rather than their current income constrains portfolio decisions, i.e. a person's choice regarding how to hold his or her wealth. It is to be noted that Friedman (1956) defined wealth in a broader way than the proponents of Keynesian liquidity preference theory. In neo-quantity theory, the wealth variable encompasses human wealth and physical capital in addition to money and non-money financial assets (see Hosek and Zahn, 1977: 123). Friedman's (1956) demand for money function is thus by far more complex than the one derived from the classical quantity equation and can be, based on Friedman and Schwartz (1982), expressed as

$$M^D = f(r_m, r_s, r_b, E_\pi, W) \cdot P, \tag{3-4}$$

where f(.) refers to the velocity of money which varies systematically in response to changes in different variables, including the return of several assets (e.g. return on money stored in interest-bearing bank accounts r_m; return on stock r_s; return on bonds r_b), the inflation rate (E_π) and total wealth (W). In practice, permanent income mostly serves as a proxy for the wealth variable and the market interest rate r replaces the return variables included in equation 3-4. When thinking of f(.) in terms of the velocity of money, Friedman's demand for money function closely resembles the original quantity equation presented at the beginning of this section. However, unlike the pre-Keynesian theorists, Friedman did not assume the velocity of money to be constant. Nevertheless, by contrast to the Keynesian hypothesis, the velocity of money is a stable function of a few measurable variables which makes the effects of changes in the quantity of money again predictable (see Dostaler, 1997: 94). The opinion shared by most contemporary economists is that in the long run an increase in the quantity of money only affects the price level but has no consequence on the real sectors of the economy. In the short run, however, neo-quantity theory predicts that changes in the quantity of money affect real variables like real income and employment. The absence of any long-term effect is a result of the definition of money as a special asset which is never held for the sake of permanently possessing it. As soon as the quantity of money circulating in an economy increases, people will use the additional bank notes to buy financial assets and durable goods. Production rises, money incomes increase and people finally also start buying more consumption goods. This causes inflation leading to a number of feedback processes; for example, the demand for credits by firms, which expect that prices will increase even further, decreases, leading to lower levels of production and employment. In the end, all temporal real effects are offset by the increase in the general price level. In short, money is neutral.

Naturally, monetary theory has not stopped developing since Friedman's restatement of quantity theory. However, the more recent models turned out to be neither more adequate in terms of making reliable predictions about people's demand for money, nor do they attribute a different role to money as compared to neo-quantity theory. Starting in the 1960s, much work focussed on further refining Friedman's (1956) version of the money demand function. Most notably, several economists attempted to provide 'a sound micro-foundation' (Laidler, 1993: 2) of the demand for money theory. The representatives of the corresponding stream of literature (Sidrauski, 1969, Clower, 1967, Hahn, 1982, McCallum and Goodfriend, 1987, Baumol, 1952, Tobin, 1956 to list but the most cited articles) aimed at explaining agents' desire to hold money in terms of individuals' preferences and their budget constraints. They analysed the demand for money in the same way as the demand for genuine goods and services, i.e. as a utility maximisation problem. The probably best-known, and, as argued by Mankiw (2010: 559) still the leading model in contemporary theory of money demand is the Baumol-Tobin model of cash management. Baumol (1952) and Tobin (1956) treated money (i.e. currency and checkable deposits) as a creator of time; people can save time and resources by holding part of their income in the liquid form. When making a purchase their cash balances allow them to avoid time-consuming trips to the bank and to save the brokerage fees they would otherwise have to pay in order to convert wealth invested in profitable assets back into cash. Baumol (1952) and Tobin (1956) analysed the demand for money as a choice problem where individuals weigh the benefits of holding money (i.e. convenience) against the costs it implies (i.e. forgone interest income obtained from more profitable stores of wealth). In spite of the fact that many of the corresponding models are mathematically highly complex and therefore sometimes difficult to grasp, transaction theories provide only limited insight regarding people's actual behaviour with money. As in classical economics, money merely takes the role of a neutral medium of exchange which has no other function than facilitating the act of paying. To a greater extent than before, transaction theories are of little help for the prediction of the amount of money people wish to hold nowadays. This is partly due to the multiple financial innovations during the last decades which complicate the analysis of people's demand for money. Today, people can easily convert their money stored in an interest-bearing savings account into cash and, up to a certain amount, banks do not charge brokerage fees. Furthermore, thanks to the development of online banking, moving resources from a savings account to a checking account is more convenient than in the past. Hence, arguing that money is a creator of time and holding it saves resources is less evident than before so that transaction theories like the one proposed by Baumol (1952) and Tobin (1956) appear rather obsolete. Furthermore, as stressed by Laidler (1993), none of the micro-founded demand for money models which have been developed in the second half of the twentieth century would correctly predict the sums of money that people actually hold in cash or the great amounts of money stored in saving accounts which earn little interest. Transaction demand theories tend to underestimate the amount of wealth held in liquid forms systematically. Taken together, correctly predicting people's demand for money remains a great challenge in economics.

Differing concepts of money in macroeconomics: Keynes vs. Friedman

Some readers might have missed a sound definition of the assets that economists consider as 'money' at the beginning of this chapter. Providing such a definition is, however, quite challenging. There seems to be no unambiguous definition of money among economists. Different authors mean different assets (coins, notes, bank deposits, financial instruments) when employing the term money and analysing, for example, people's demand for it. This issue is not limited to the differing concepts of money employed before the so-called Keynesian revolution and afterwards but sometimes even appears within a single work written by the same author. Different concepts and the use of partly inconsistent definitions of money are particularly striking when reading and comparing the publications by Keynes and Friedman. These two economists extensively wrote on money, on its history and both of them made recommendations which decisively shaped monetary policy. Money is a key concept in Keynes' work; the term 'money' appears in the titles of his most cited publications (i.e. *A Tract on Monetary Reform*, 1923; *A Treatise on Money*, 1930; *The General Theory of Employment, Interest and Money*, 1936). Similarly to Keynes, Friedman's name is frequently associated with money in economics, for example by recalling his popular 'Money matters' slogan or the famous analogy of the money-dropping helicopter (cf. Friedman, 1973).

Several economists have stressed that Keynes ([1936] 2009) employed the term money and analysed what was meant by it in a different way than the Classics did (see e.g. the different contribution in *Keynes and the Classics Reconsidered* in Ahiakpor, 1998a). Rather than merely analysing the public's demand for currency (i.e. coins and notes), as the proponents of the old quantity theory did, Keynes also included bank deposits into his definition of the money stock (cf. e.g. Keynes, [1936] 2009: 194-195). However, as highlighted by Ahiakpor (1998b: 20), Keynes was not consistent in his definition of money. In most instances, he meant only cash (i.e. currency and checking deposits), especially when developing the liquidity preference theory (cf. GT, chapter 13). Sometimes, however, he referred to a broader definition of money and referred also to time deposits, financial instruments such a treasury bills and occasionally even credit agreements when employing the term 'money' in the *General Theory* (cf. Keynes, [1936] 2009: 167, footnote 2). Friedman and Schwartz (1969) referred to an even broader set of assets when analysing the demand of money than Keynes did, namely to currency, plus demand deposits, plus time deposits. Hence, in spite of some inconsistencies in the *General Theory*, Friedman employed the term money in a broader way than Keynes did .[6]

Even more differences regarding their conceptions of money can be observed when comparing how Keynes and Friedman wrote on its nature and people's perception and uses of money (the following arguments are broadly adapted from Dostaler, 1997: 89-94). According to Keynes ([1930] 1971: 13), money is an 'essential element of civilisation' and not just as a lubricant

[6] Using the empirical definition of money which can be found in contemporary textbooks (cf. e.g. Samueslon, 2001: 515) a reader may conclude that Keynes analysed money in the narrow sense (M1, including currency, demand deposits and other checkable deposits) and Friedman analysed broad money (M2, including saving accounts and time deposits in addition to M1).

which facilitates the exchange of goods and services. Therefore, money's history, social conventions, people's habits and feelings have to be taken into account when analysing the role of money in the economy. When reasoning about people's desire to store wealth in a liquid rather than in an interest-bearing form, Keynes (1937: 116) highlighted that people have a feeling about money which is 'partly (…) reasonable partly (…) instinctive' and which 'operates, so to speak, at a deeper level of motivation'. According to him, the possession of money settles people's disquietude about their future resources. Keynes thus pointed to a psychological dimension of money which had never been addressed in economics. In the *General Theory*, he introduced two psychological variables which determine, according to him, people's consumption and saving decisions: the propensity to consume and liquidity preference. As illustrated in the previous part of this section, the latter variable has attracted by far more interest than the former in macroeconomics. The propensity to consume is, however, also interesting for an analysis of Keynes' concept of money. The propensity to consume refers to the share that people spend out of their income. According to Keynes ([1936] 2009), it is determined by both 'objective factors' (cf. GT, chapter 8) and 'subjective factors' (cf. GT, chapter 9). While the first set of factors encompasses the traditionally considered variables like a person's income level, the subjective factors include, among other aspects, 'psychological characteristics of human nature' (Keynes, [1936] 2009: 91). Keynes ([1936] 2009: 107-108) listed eight motives which lead individuals to retain part of their income, namely (i) precaution, (ii) foresight, (iii) enjoyment of interest income, (iv) enjoyment of gradually increasing expenditures, (v) independence, (vi) enterprise, (vii) bequest and (viii) avarice. Especially the fifth and eighth motives refer to a psychological, if not pathological dimension of people's tendency to accumulate or hoard their financial resources. Not only people's preference for future consumption motivates non-spending. In addition to the traditionally considered motives, irrational feelings 'of independence and the power to do things, though without a clear idea or definite intention of specific action' or even 'pure miserliness, i.e. unreasonable but insistent inhibitions against acts of expenditures as such' (Keynes, [1936] 2009: 108) drive non-spending. As stressed by Dostaler (1997) and Dostaler and Maris (2000), Keynes was acquainted with the psychological literature on money of that time, especially with the theory of the love of money developed by Freud ([1908] 1976) and other psychoanalysts (cf. section 4.1.1). Although he did not repeat the partly greasy theories that circulated in the psychoanalytical literature of that time, Keynes seemed to maintain the idea that hoarding behaviour was the outcome of some irrational love of money and that it had psychological roots (see Dostaler, 1997: 91).

The philosophical and psychological foundations of money which a reader finds in Keynes' work are absent in Friedman's monetary analysis. In neo-quantity theory, money is an instrument which facilitates exchange and which is, as a temporary abode of purchasing power, sometimes used as an asset to store wealth. It is neutral when managed adequately by the governmental authorities. In his 'restatement' of quantity theory, Friedman (1956: 21) went as far as to compare the uniform relationship between the quantity of money and the general price level to other

'uniformities that form the basis of physical sciences'. As explained above, Friedman and other proponents of neo-quantity theory consider the demand for money as a stable function of a few objective variables (c.f. Dostaler, 1997: 93-94). People's taste for money is assumed to be constant over time and space. Friedman's monetary theory and its variants developed in the second half of the twentieth century leave no space for miserliness, compulsions or untargeted asset accumulation. Today, Friedman's functional approach rather than Keynes' vision on money dominates economic thought. Not even Keynes' followers have put any effort into maintaining any of the psychological dimensions of people's perceptions and behaviour with respect to money.

Summing up, like in microeconomic theory, money appears as a neutral medium of exchange in the macroeconomic framework. Early twentieth century economists already recognised the importance of money's role as a store of wealth for explaining why people wish to hold cash. Keynes ([1936] 2009) and his followers explicitly accounted for this second function of money. Keynes even argued that people's desire to accumulate cash may become insatiable in certain situations. However, this proposition was relatively quickly wiped out by a number of empirical studies, Friedman's (1956) restatement of quantity theory and the reorientation towards the transaction demand for money since the 1960s. Furthermore, Keynes stressed the importance of psychological factors for people's desire to hold money. However, these factors are neither included in any of the stylised demand for money functions he described himself nor in the models developed by the Keynesian economists. Similar to Keynes, Friedman also acknowledged the effects of psychological factors like pessimistic expectations about future incomes and individual differences in the importance attached to the non-pecuniary services of money (i.e. liquidity, convenience and safety) on people's demand for money. However, such subjective variables are typically absent in the aggregate demand for money function or the (neo-) quantity equation, presumably because they are difficult to assess empirically and because most researchers believe them to be of little importance at an aggregate level.

3.3 Behavioural economists on money

As stressed in the previous section, Keynes' writings are full of arguments which point to the psychological dimensions of people's perception and behaviour with respect to money. However, individual attitudes or personality traits which Keynes suspected to affect people's consumption, saving and investment decisions are absent in mainstream economics, including both macro- and microeconomics. According to neoclassical economic theory, the pure accumulation of money never yields satisfaction; only the depletion of money and other financial assets increases a person's utility. Surprisingly, not even behavioural economists seem to question the assumption regarding the neutrality of money for people's consumption and saving behaviour. Apart from the broad literature on money illusion (c.f. e.g. Shafir et al., 1997), behavioural economists have paid surprisingly little attention to the anomalies in people's spending behaviour. The studies which demonstrate that people sometimes think in nominal rather than in real monetary

values are too numerous to be comprehensively reviewed in this section. Furthermore, money illusion appears to be of limited relevance for the present work which focuses on the role of money in contingent valuation studies. Aside from the case where researchers implement a CVM survey shortly after a currency change, it is unlikely that money illusion distorts the results of an environmental valuation study (cf. Mathieu and Riera, 2010 for an interesting investigation of the 'euro illusion' in CVM surveys conducted in Spain shortly after the introduction of the new currency). Instead of repeating the debates about significance or irrelevance of money illusion in real life, this section focuses on two less popular niches of behavioural economic research, namely empirical research in behavioural finance conducted in Germany in the 1950s and a more recent stream of literature regarding the psychological costs of parting with money. First, the early work of Günter Schmölders – a German economists who is mainly known for his work in finance and less for his contributions to behavioural economics – on the 'psychology of money' and its relevance for public finance will be introduced. The second part of this section focuses on the so-called pain of paying literature.

3.3.1 Günter Schmölders' pioneer work

In 1966, Schmölders published the first edition of *Die Psychologie des Geldes* (Schmölders, 1982). *The Psychology of Money and Public Finance* (Schmölders, 2006), an English translation of Schmölders' work that appeared 50 years later, contains parts of this first publication to which non-German speakers had no access for a long time. However, even in Germany, economists are rarely familiar with Schmölders' psychology-oriented work. The present section therefore focuses on introducing Schmölders' alternative view on monetary economics, on the methods he employed to account for psychological variables when analysing people's monetary behaviour as well as on some selected results of Schmölders' pioneering empirical research.

In the two books on which this section is based, Schmölders' (1982, 2006) criticism of the macroeconomic models which were used to make forecasts and policy recommendations in the 1960s is paramount. It is especially expressed in the following citation, 'The unfortunate state of affairs (…) is that authors not only waste much time and energy on such irrelevant considerations as the formalization of money demand, velocity of circulation, income-expenditure formulas and the like but also block publication space by splashing their petty squabbles about the importance of quite insignificant parameters or impractical variable definitions all over the pages of renowned journals' (Schmölders, 2006: 94). Unlike most of his colleagues, Schmölders observed individual differences in handling money and theorised that there was a noticeable interplay of psychological variables and people's spending, saving, borrowing and investment decisions. He considered one of the key assumptions that the proponents of monetary theory made at that time as particularly warranted, namely that all individuals in an economy act in the same way, in spite of their differences in income (see Schmölders, 2006: 97). According to Schmölders (2006: 91), understanding 'how millions of individual decisions cause the figures of our bank statistics to swell or dwindle' should be an essential element in public finance. 'Attitudes towards money and its part as a symbol are the 'sesame' which opens the road to an understanding of inflation or

stagnation' (Schmölders, 2006: 97, emphasis in original). He theorised that people's behaviour with money is systematically affected by character traits and attitudes towards certain forms of monetary behaviour. He believed that accounting for groups of people with differing character traits and attitudes, including extreme types of consumers like pathological misers and spendthrifts, would alter the predictive power of economic models. To underpin his argument, he initiated several household surveys on people's decisions to spend, save and borrow money. Schmölders (1982) repeatedly cited the results of one of these surveys, namely the data from a representative sample of 1,050 households in the Federal Republic of Germany, gathered in 1959 by the Cologne Research Centre for Empirical Social Economy together with the Allensbach Institute for Public Opinion Research, throughout three chapters of his first book (Schmölders, 1982: chapter II, III and IV).

Based on this survey, Schmölders (1982) examined the question as to how individual attitudes towards saving, psychological character traits like extraversion and self-discipline as well as some of the popular character types discussed in the psychoanalytical literature at that time were related to people's monetary behaviour. The associated questionnaire encompassed a great number of self-report statements which were used to classify respondents according to their attitudes towards saving and into clusters of individuals with similar character traits. Naturally, the survey also accounted for more than psychological variables, such as disposable household income, demographics and the social and economic environment of the respondents. The author was aware of the possibility that more objective factors (income, age, household size, etc.) compensated or even completely mediated the psychological personality variables of interest. Therefore, he accounted carefully for these demographic variables when analysing the survey data (see Schmölders, 1982: 75). One of the key research questions that motivated his work relates to analysing the predictive power of psychological variables as compared to demographic and social variables for spending and saving behaviour and to identify the relationship between these two sets of variables (see Schmölders, 2006: 97).

Elicitation of psychological variables[7]

Schmölders' (1982) accounted for an impressive number of attitudinal questions in his household surveys. Table 3-1 gives an overview of the items which he used to assess attitudes towards saving and the different personality characteristics he wished to identify. The four questions displayed in the first column of Table 3-1 were used to classify respondents into groups of people with similar levels of thrift. Based on the number of 'thrifty' answers a respondent had given, he or she fell into one out of five categories reaching from 'very wasteful' to 'very thrifty'. It turned out that thriftiness was a decreasing function of income and that the level of thrift systematically

[7] It is to be noted that the techniques which Schmölders' (1982) employed to classify survey respondents according to their attitudes towards saving and character traits appear unnecessarily complex from today's perspective. However, in the absence of sophisticated statistical software, in a time before the breakthrough of econometrics and before psychometric scales for the measurement of psychological variables became widespread, Schmölders and colleagues probably had no other choice than relying on these, from today's perspective, partly obsolete methods.

increased with the number of people living in a respondent's household. Hence, differences in income and household size had to be taken into account to analyse the effect of thrift on monetary habit (cf. Schmölders, 2006: 73-74). In order to neutralise the correlation between thrift, income and household size, Schmölders (1982) applied group-specific rules to divide the sample into 'free spenders' and 'penny pinchers', the former having reported a below average level of thrift and the latter an above average level of thrift. For example, large households with a low household income had to answer more test questions positively in order to fall into the classification of 'thrifty' households than small households with a high income.

Schmölders (1982) employed 19 items regarding a set of undesirable characteristics and 17 items relating to virtues to measure personality traits. Each respondent had to tick all items which fitted his or her personality out of these two lists. Naturally, these lists did not simply contain words like 'resentful', 'meticulous' or 'avaricious' displayed in Table 3-1; all 36 characteristics were assessed by means of statements which paraphrased the meaning of the traits in a nicer sounding way. For example, rather than asking respondents whether they were 'avaricious', Schmölders (1982: 39, own translation) formulated the following sentence: 'I allow myself too little, some people say that I am stingy'. In a similar way, he accounted for the personality trait 'extravagant' by asking the respondents whether or not they agreed with the statement 'I am somewhat wasteful, I spend my money easily' (ibid.). It turned out that certain combinations of traits were chosen rather frequently across respondents (cf. Schmölders, 1982: 40). Schmölders (1982) used these repeatedly coinciding traits to build four broader personality dimensions, namely punctilious vs. easy-going, orderly vs. desultory, vigorous vs. weakly and introverted vs. extroverted psychological types. For each of these four pairs, he defined a particular classification rule. For example, respondents who had ticked at least four items of the left list displayed in the second column of Table 3-1 (resentful, meticulous, avaricious, thorough, etc.) but less than two items of the right list (extravagant, inconstant, etc.) fell into the 'punctilious' cluster, while those who ticked more than two items from the punctilious-list list but less than three from the easy-going-list self-classified as 'easy-going'. The eight cluster variables were used to conduct a number of statistical tests against other variables.

Table 3-1: Psychological variables analysed by Schmölders (1982, 2006)

Attitudes towards saving	Personality characteristics	
1. Would you think that thriftiness is an essential and desirable quality of character?	**Punctilious**	**vs. Easy-going**
	resentful	extravagant
	meticulous	inconstant
	avaricious	untidy
	thorough	light-minded
	austere	erratic
	punctual	
2. Suppose you would like to see a particular movie. But as you get to the theatre all except the expensive balcony seats are sold out. Would you still see the film or would you rather return some other night?	**Introverted**	**vs. Extroverted**
	resentful	talkative
	timid	vain
	contemplative	convivial
	inward-looking	
3. Suppose you have just been to visit someone and as you want to return home you miss the bus. Your alternatives are to wait two hours for the next bus or to take a cab and pay about six D-mark. What would you do?	**Vigorous**	**vs. Weakly**
	ruthless	undecided
	hot-tempered	compliant
	smart	timid
	responsible	contemplative
	energetically	
	staunch	
4. These are three opinions about saving? With which one would you agree?	**Orderly**	**vs. Desultory**
a. Saving? I think one should enjoy life now with the money one has. (…)	self-controlling	lazy
	persistent	capricious
	energetically	untidy
	staunch	talkative
	inward-looking	compliant
b. In my opinion one should think twice before spending a penny, one should save as much as possible and if necessary give up a thing or two in life.		hot-tempered
		mercurial
		unpunctual
		inconsistent
c. I think it makes a lot of sense to save money, but within limits. (…)		

Discussion of selected results

There are at least two interesting outcomes of Schmölder's (1982, 2006) work which are worth mentioning in this section. First, the descriptive statistics regarding the distribution of different attitudes towards saving, different personality traits and personality clusters give an impression regarding the relevance of a number of exaggerated if not pathological money-related habits in the German population in the late 1950s. Second, even though the statistical analysis appears somewhat rudimentary as compared to contemporary standards, the study shows that there are undeniable relationships between a number of psychological variables and people's spending and saving behaviour.

Regarding saving attitudes, Schmölders (1982: 47-48) derived six groups of consumers: the 'very thrifty' (12%), 'thrifty' (19%), 'wasteful' (5%) and 'very wasteful' (6%) as well as a group situated in between of the two extremes (58%). The extreme cases, i.e. the 'very thrifty' and the 'very wasteful' represent only small shares of the sample; however, these groups of people are also too big to be ignored. Schmölders (1982) did not go into details concerning the question as to how 'very thrifty' and 'very wasteful' consumers would fit the picture of the utility-maximising consumer or whether they were likely to behave irrationally. For example, he did not discuss whether a great importance attached to the principle of thrift and saving was ill-founded. However, a reader easily reaches the conclusion that a 'very thrifty' individual, i.e. a financially well-off respondent who persistently revealed thrifty attitudes when answering the four test questions (cf. first column of Table 3-1) is likely to have some non-economic motives for saving and not just a pronounced taste for future consumption. Some of the 'very thrifty' respondents might not simply be disciplined savers, but individuals who attach unreasonable importance to the act of saving as such.

Concerning personality traits, it is noticeable that Schmölders (1982) identified a surprisingly high number of avaricious people. 14% of all respondents admitted that they behaved miserly. An even greater proportion of 20% described themselves as wasteful (see Schmölders, 1982: 39). Again, Schmölders (1982) did not argue that the behaviour of these misers or spendthrifts was irrational, unhealthy or even pathological. However, it is striking that the amount of misers – a group of people economists typically disregard – was that large in the household survey he considered. At the same time, these results should not be overestimated. Schmölders (1982) measured personality traits like miserliness or extravagance by single self-report items. Hence, there might be considerable measurement error in the corresponding variables. Some respondents may have interpreted the given characteristics differently; others could have mistakenly ticked an item that did not apply to their personality. Furthermore, a number of people probably wanted to display themselves in a certain way that they thought was desirable.

In addition to a detailed overview of descriptive results, Schmölders (1982) also reported the results of some inferential statistical tests and drew conclusions concerning the statistical relationship between attitudes towards saving, the surveyed character traits and trait clusters with other variables, including a number of behavioural variables. For example, he showed that the monetary habits of thrifty households importantly differed from the habits of their lavish counterparts. As compared to the more wasteful half of the sample, thrifty households were more inclined to use calculation when planning their budget and applied more stringent rules for saving; they were more likely to look for bargains; and they tended to be generally opposed to taking out a credit or to borrow money from friends. In the words of Schmölders (2006: 85), 'their psychological alarm is triggered more readily than others when their level of liquid funds falls'. These results are particularly interesting, given the fact that the income-adjusted 'free spenders' vs. 'penny pinchers' classification was essentially unrelated to social and demographic variables, like a person's residence, religion, gender or age. At the same time, Schmölders (1982) found

that attitudes towards saving were systematically correlated with many personality characteristics. For example, high levels of thrift occurred particularly frequently among austere and consistent respondents, while low levels were more frequent among the easy-going, extroverted and desultory individuals. Furthermore, the psychological factors systematically affected self-report attitudes towards gambling, running up debts and respondents' self-perceived ability to handle their money. For example, people who had self-classified as avaricious and staunch mostly attached high importance to saving, were opposed to gambling, would hardly ever apply for a credit and highlighted that they were particularly skilled in handling their money. People who had self-classified as wasteful, frivolous and untidy shared very different habits and attitudes. These people tended, on average, to behave generously with their money, attached little importance to saving and were less opposed to the idea of borrowing money. Extravagant, shallow, untidy and inconsistent respondents more often pretended that they had not been able to put money aside during the last two months. By contrast, austere, punctual and efficient respondents more often belonged to the group of regular savers. Avaricious, austere and meticulous individuals tended to 'think twice before spending anything, save as much as possible, and feel relaxed about denying yourself some things in life' (cf. question 4 in Table 3-1). Opposed to that, a considerable share of extravagant, easy-going, carefree, vain, inconsistent and lazy respondents stated that they saw no sense in the idea of saving. Taken together, the survey results show that psychological traits predict money-related principals and habits, notably a household's saving behaviour. Neither income nor age or any other demographic variable outdo these effects.

In sum, Schmölders' (1982) survey results impressively demonstrate that spending, saving and borrowing habits greatly differ across the different clusters of consumers. These differences are particularly striking when comparing extreme cases like misers and spendthrifts or very thrifty and very wasteful individuals. They also indicate that potentially ill-founded attitudes towards non-spending, i.e. extreme thriftiness and miserliness, are more widely distributed in the general population than one may expect, given the complete negligence of such attitudes in mainstream economic theory. Schmölders (1982) found his expectations regarding the importance of psychological factors for actual monetary decisions to be confirmed. He concluded that monetary behaviour was not a simple function of income but an expression of a broad set of psychological factors and even called for 'a revision and gradual rewriting of monetary theory' (Schmölders, 2006: 116). As everyone knows, such a revision has never taken place and Günter Schmölders' research on the psychology of money is largely unknown in contemporary economics.

3.3.2 The Pain of Paying

While Günter Schmölders called for a revision of the macroeconomic framework, similar arguments as those proposed by this German economist can be found in more micro-oriented behavioural economic literature published in the U.S. several decades later. The observation that purchasing decisions are not always made in the way as predicted by neoclassical economic theory gave space to extensive research in behavioural economics. From the neoclassical perspective, a

consumer who is faced with the situation of spending x€ on a particular good should compare the marginal utility accruing from the consumption of this good to the opportunity costs of the purchase, i.e. the forgone benefit of spending x€ on something else. In practise, many consumers do not consider the opportunity costs of their choices spontaneously (cf. Frederick et al., 2009). Some behavioural economists have proposed that opportunity costs are often neglected because benefit-cost calculations are cognitively too demanding in many situations. Nevertheless, most people are able to manage their budget rather well. The stream of literature considered in this section suggests that many people rely on some negative feelings related to the act of spending money rather than explicitly thinking of opportunity costs when making purchases. The psychological cost of parting with money has become popular as the 'pain of paying' (PoP), a concept first proposed by Prelec and Loewenstein (1998). The latter two authors based their hypotheses on Thaler's (1985) framework on mental accounting, especially the concept of so-called 'transaction (dis)utility' (ibid: 210). Transaction utility refers to the perceived benefits of making a 'deal', i.e. paying a particular price for a desired good. Transaction utility is detangled from any utility accruing from consuming this good and only 'depends on the price the individual pays compared to some reference price' (ibid: 205). Transaction utility will be high when individuals think that they have made a good deal, i.e. when the price they actually paid is substantially lower than the regular price that the individual expects to pay for the good in question (cf. Thaler, 1999). Transaction utility will be negative when the actual price exceeds the reference price. The PoP evidently resembles the concept of transaction utility. Nevertheless, while the latter is viewed as being mainly determined by an individual's perception whether or not the price of a desired good is 'fair' (see Thaler, 1985: 205), the PoP relates to more stable psychological factors, like an individuals' personality and attitudes towards spending money in general.

Much research has focused on the question whether the psychological cost of spending causes consumers to behave rationally or whether it systematically distorts their consumption choices. Rick et al. (2008) suggested that the PoP is a good proxy for opportunity costs in many cases. In other words, relying on the PoP often leads to the same spending decision as thinking of the next best use of the amount of money necessary to be spent in order to obtain a particular good. However, some people have a chronic tendency to experience too much pain, i.e. they generally overestimate the opportunity costs. Others feel too little pain, i.e. they mostly underestimate the opportunity costs of their choices, according to Rick et al. (2008). The authors called those who feel high levels of pain when parting with money 'tightwads' and their counterparts 'spendthrifts'. To make the degree of pain people experience when making purchases measurable and to test their hypothesis, they developed a short psychometric inventory. This tightwads-spendthrift questionnaire, which is displayed in Table 3-2, has been employed in several empirical studies since its publication. Researchers have used the tightwad-spendthrift scale to classify respondents into different clusters of consumers (e.g. tightwads, spendthrifts and un-conflicted consumers, cf. Rick et al., 2008) or to construct a continuous variable that measures an individual's tendency to experience the PoP.

In the initial study, Rick et al. (2008) classified 24% of almost 10,000 survey participants as tightwads, 15% as spendthrifts and the remaining respondents as un-conflicted consumers. Once again, these figures should not be overestimated because they critically depend on the assumption regarding the cut-off levels, i.e. the score a respondent has to reach to fall into one of the three categories. Rick et al. (2008) employed a classification rule that may be too weak (strict), so that the reported share of tightwads is higher (lower) than the actual share. In spite of such methodological limitations, the study provides some interesting relationships between tightwaddism and a number of economic variables. Rick et al. (2008) showed that high levels of tightwaddism predict higher saving-account balances but that scores on the tightwad-spendthrift scale are unrelated to income. Based on these results, Rick et al. (2008) concluded that the purchase decisions of tightwads are not constraint by their actual budget constraint but by their (mis)perceived ability to spend. In other words, tightwads tend to overestimate the magnitude of prices and to underrate their financial resources, causing them to act stingy.

Rick (2008) had a closer look at the level of psychological pain when making different kinds of purchases. Using the responses of 8,000 survey participants, he found that tightwads felt more pain than spendthrifts in the case of 21 out of 24 different types of expenditure. While tightwads reported to feel more pain when spending money for things like clothes, books, beverages, gifts, vacation or their favourite hobby, there was no significant difference regarding the level of pain perceived by tightwads on the one hand and spendthrifts on the other in the case of donations, health care and life insurance. These results indicate that although high levels of PoP predict frugal or zero spending across many situations, the effect of the psychological cost of parting with money may be out-done when it comes to investments (medical check-ups, buying insurance) and altruistic behaviour (donations). In addition to the outcome of the two surveys cited above, the results of a number of brain scanning experiments have added to the relevance of the PoP. Knutson et al. (2007), for example, found that the region of the brain which is active when people experience distress is often also activated when people observe prices. In the case of its activation, participants of the brain scanning experiments were less likely to buy (i.e. to click on a 'purchase' button on a computer screen after having been shown a certain product and its price). These results add to the hypothesis that pain is at work when people decide on their purchases and that this pain systematically influences spending decisions.

Apart from these insights, many questions regarding the PoP are still unanswered. For example, it is not quite clear whether the PoP is constant for every purchase situation or if its intensity varies with the price of a product. As highlighted by Rick (2013), it is plausible that the PoP increases with a good's price. However, the results of brain-scanning studies contradict this hypothesis; they reveal that the intensity of the PoP is individual- but neither price- nor situation-specific. Furthermore, it is not clear how the consideration of opportunity costs and the PoP relate to each other. Prelec and Loewenstein (1998) suggested that the PoP was a substitute for the consideration of opportunity costs. In other words, they proposed that a consumer thinks of the next best use of his or her money *or* relies on the PoP when making a purchase decision. The

results reported by Frederick et al. (2009) suggest, however, that people who score high on the tightwad-spendthrift scale are also more likely to actively think of opportunity costs. As argued by Rick (2013), tightwads might feel more inclined to perceive prices in terms of opportunity costs. Accordingly, the PoP seems to be a function of opportunity cost consideration. Furthermore, it may be the case that tightwads and spendthrifts systematically differ in terms of their preferences, for example that tightwads generally experience less pleasure from consumption than spendthrifts. Another and in terms of economic theory less compatible explanation could be that some pathologic attitude towards money is at work. Like a miser, a tightwad may attach anomalous importance to the accumulation of money and therefore behave extremely reluctant when it comes to spending money.

Table 3-2: The tightwad-spendthrift questionnaire (Rick et al., 2008)

1. Which of the following description fits you better?

O	O	O	O	O	O	O	O	O	O
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Tightwad (difficulty spending money)			About the same or neither				Spendthrift (difficulty controlling spending)		

2. [Description of A) a spendthrift and B) a tightwad]

A) How well does the first description fit you? That is, do you have trouble limiting your spending?

B) How well does the second description fit you? That is, do you have trouble spending money?

O	O	O	O	O
(1)	(2)	(3)	(4)	(5)
Never	Rarely	Sometimes	Often	Always

3. Following is a scenario describing the behavior of two shoppers. After reading about each shopper, please answer the question that follows.

   (…) Mr. A sees that the store has a "one-day-only-sale" where everything is priced 10-60% off. He realizes he doesn't need anything, yet can't resist and ends up spending almost $100 on stuff.

   (…) Mr. B sees that the store has a "one-day-only-sale" where everything is priced 10-60% off. He figures he can get great deals on many items that he needs, yet the thought of spending the money keeps him from buying the stuff.

   In terms of your own behavior, who are you more similar to, Mr. A or Mr. B?

O	O	O	O	O
(1)	(2)	(3)	(4)	(5)
Mr. A		About the same or neither		Mr. B

Taken together, the two streams of behavioural research presented in this section point to the existence of people with ill-founded attitudes towards spending money. Although Keynes (1936) touched upon similar topics, psychological variables like exaggerated thriftiness, greed, miserliness or tightwaddism have never found their place in neoclassical economic theory. They are typically considered as 'too psychological' or even irrelevant because only an insignificant share

of the population can be expected to fall into the categories of consumers whose attitudes challenge the economic concept of money. However, the empirical research by behavioural economists shows that a person's disposition to spend money in general, reaching from extremely wasteful to pathologically stingy, matters importantly for his or her spending and saving decisions. Furthermore, the share of people with potentially abnormal attitudes towards spending money appears to be small but is significant in the empirical studies reviewed in this section. As already mentioned, these studies are likely to overestimate the actual share of misers within the general population. Nevertheless, accounting for individual differences in the disposition to spend money in general may contribute to a better understanding of people's money-related behaviour as compared to the standard approach, which consists of analysing economic decisions in terms of representative households that differ merely in terms of their financial resources.

Summary of chapter 3

This chapter illustrated the economic perspective on money. As stressed throughout the different sections, economists have traditionally treated money as a neutral medium of exchange. According to the exchange theory on the origins of money, that most students in economics get to know during their first study term, money emerged as a universally accepted means of payment which reduced the inconveniences of a barter economy. Although historical facts do not fully sustain the medium of exchange theory and alternative explanations regarding the origins of money have been proposed, this theory still dominates economic literature on money. Similar to the receipts emitted by the goldsmith-bankers in the medium of exchange theory, the value of modern money does not arise from its material value but is rooted in the fact that people can exchange it against virtually any desired object. Economic theory correctly accounts for this technical fact and postulates that rational individuals would never value the possession of money as such but merely the things that money can buy. Money is neutral in the sense that it does not affect an individual's preferences over goods and services. This neutrality postulate is a key element in both microeconomic and macroeconomic theory. In microeconomics, money takes the secondary role of a numéraire in which prices and income are expressed. Individuals exchange their money income in order to satisfy their needs and wishes, but they do not gain any utility when leaving their financial resources untouched. From the macroeconomic perspective, neutrality means that a change in the quantity of money has no lasting effects on the real variables such as output, real income and employment. An increased supply of coins and notes by the central bank, for example, can only result in an increase in the general price level and higher nominal incomes, because rational economic agents will spend these coins and notes. In macroeconomics, many debates have centred on the question as to how people's demand for money can be correctly determined. Although there are diverging views regarding the key determinants of people's choice to hold a certain proportion of their wealth in the liquid form, researchers typically employ some simple function of a few objective variables, most importantly income levels and interest rates, to assess monetary demand.

One of the first economists who openly expressed his criticism towards the macroeconomic framework was Günter Schmölders. This German economist called for analysing individual decisions in more detail in order to make more correct predictions regarding people's money-related behaviour. Using data from representative surveys of Western German households in the 1950s, he showed that attitudes towards saving, personality characteristics like miserliness and broader traits such as conscientiousness had by far more explanatory power for people's spending and saving decisions than disposable income and other variables which had been traditionally considered in economic analysis. More recent empirical research adds to the relevance of Schmölders' arguments. The pain of paying literature, for example, impressively shows how individual differences in the psychological cost of parting with money affect people's consumption behaviour. In line with the results of Schmölders' surveys in post-war Germany, Scott Rick and other representatives of the pain of paying literature found a relatively large share of people within the general population who seem to attach unconventionally high importance to non-spending. Based on these recurring empirical findings, it can be speculated that the neutrality postulate – money is never desired for its own sake but for the sake of the things it can buy – does not always hold in practise. Misers, penny-pinchers or tightwads may violate this postulate in the sense that they tend to hoard their liquid funds, that they save for the sake of saving and that their utility increases with the amount of money they retain rather than with the amount of money they spend. The psychological literature on money introduced in the next chapter further adds to this supposition. Personality theorists and social psychologists have extensively investigated money-related topics such as ill-founded perceptions of money and wealth and some people's neurotic tendency to retain their financial resources.

4 Money in psychology

In this chapter the psychological perspective on money will be introduced. The main focus lies on two psychological paradigms that have been applied to people's perception of and behaviour with money, namely psychoanalysis and social psychology. Before entering into more detail regarding the role of money in these two branches of psychology, the scope and history of psychological research on money as well a number of definitions, including the psychological concept of money, shall be narrowed down.

Nowadays research on money appears to be as popular among psychologists as among economists. Recent volumes of the *Journal of Consumer Psychology* or the *Journal of Consumer Research* contain plenty of articles which explore people's perceptions of currency and prices, people's behaviour with their financial resources and people's money-related emotions (cf. e.g. Garbinsky et al., 2014, Lasaleta et al., 2014, Lee and Tsai, 2014, Hansen et al., 2013, Muro and Noseworthy, 2013, Su and Gao, 2014, Xie et al., 2014). However, this great interest in money-related topics seems to be a rather recent development. The first comprehensive book on money, *The Psychology of Money* by Adrian Furnham and Michael Argyle, was published in its first edition in 1998 only. In the very first section of this book the two authors point to the lack of systematic research concerned with money in psychology at that time. They also highlight that there is no grand psychological theory of money. Rather than having developed specific theories and models as can be found in economics, researchers applied several psychological paradigms to money and used them to describe people's behaviour with and their perceptions of money (see Furnham and Argyle, 2000: 7). Psychoanalysis and Piagetian development theories, for example, have been applied to analyse the psychological underpinning of money-related pathologies and to develop personality typologies; in experimental psychology people's perception and reactions to currency, prices, monetary rewards and money reminders have been investigated; social psychologists have paid attention to the classification and measurement of money-related attitudes, beliefs and habits (ibid). These fields of research are of course interlinked. The classification and measurement tools, for example, were developed based on psychoanalytical theories, on clinical reports and results from experiments concerning children's and adults' perceptions and behaviour with respect to money. Furthermore, the validity of a number of psychoanalytical theories and typologies have been tested and further developed based on empirical evidence from survey research.

Furnham and Argyle (2000: 34) describe the purpose of psychological research on money as follows, 'Psychological theories of money neither assume monetary rationality nor rejoice in the countless examples of the ir- and a-rationality of ordinary people with respect to their money. They have, however, set themselves the task, of trying to understand how ordinary people acquire and demonstrate their everyday monetary attitudes, beliefs and behaviours.' Hence, the authors highlight that most psychologists do not aim to refute the economic concept of money. However, as will be shown in the following sections, certain forms of behaviours and attitudes

which are explored in the psychological literature on money are at odds with the economic concept of money as a neutral medium of exchange.

Moreover, the purely functional definition of money used in economics is often criticised and expanded (c.f. e.g. Furnham and Argyle, 2000, Belk and Wallendorf, 1990, Mitchell and Mickel, 1999, Lane, 1993). Psychologists generally agree with economists that people perceive and use money *mainly* as a medium of exchange, a store of value and a unit of account; but many of them highlight that there are also other 'sides of the coin' (Furnham, 1984: 501, Goldberg and Lewis, 1978: 81), 'more emotional, qualitative meanings of money' (Belk and Wallendorf, 1990: 36) or that money should be treated 'as a symbol as well as a sign pointing to price or exchange value' (Lane, 1993: 114) to better understand people's spending and saving behaviour. While many people perceive money as a pure tool – a medium of exchange and store of value – money may symbolise things like security, power, love or freedom in addition to its economic uses for others, according to the psychological literature on money (cf. Lea and Webley, 2006). In that sense, money is mainly worth what it can buy, but it also has great symbolic value.

The symbolic meaning of money is reflected in a person's attitudes towards money and sometimes translates into pathological forms of behaviour such as compulsive saving, obsessive and uncontrolled spending. These forms of uncommon behaviour are often called 'irrational' in psychological literature (see e.g. Goldberg and Lewis, 1978). It is to be noted that although the term 'irrational' is frequently used in the psychological literature on money, its meaning is rarely explained. It can be speculated that in the psychological literature the word is used in a broader sense than in neoclassical microeconomic theory. In microeconomics an individual is said to behave rationally as long as its choices are consistent and certain assumptions concerning an individual's preference ordering are met.[8] Similar definitions are mostly absent in the psychological literature. Lane (1993), however, who addressed the question whether certain money attitudes interfere with the economic concept of the rational consumer, proposed a definition of psychological rationality. He defined consumption choices which lead to long-term satisfaction as rational and those that merely yield 'neurotic gains' (Lane, 1993: 104) but preclude long-term satisfaction as irrational. This psychological definition of rationality is partly different from the economic one. Addiction, for example, typically translates into consistent choices and therefore falls into the class of rational choices in economics. At the same time, addiction typically does not yield long-term satisfaction; therefore, an addict has to be put into the category of irrational individuals when applying the psychological definition of rationality. Note that; in what follows in this section, I will broadly adapt the psychological terminology, rather than using the word 'irrational' in the economic sense.

[8] In the standard consumer theory an individual's tastes or preferences are described by a set of axioms. If the three 'rationality axioms' (Frör, 2007: 53), namely reflexivity, completeness and transitivity, hold, an individual is said to make consistent choices among alternative consumption bundles, i.e. his or her ranking of alternatives is logically consistent. Illogical behaviour such as choosing coffee over tea, tea over juice but juice over coffee are ruled out by the transitivity axiom.

As already mentioned, the psychological research on money-related behaviour and its psychological underpinnings has a relatively short history. There is hardly any literature prior to the 1970s available. An exception is Freud's ([1908] 1976), certainly disputable, perspective on money within his description of the anal character and the work of his fellow-travellers (see section 4.1.1). However, the relevance and the validity of the so-called theories developed by psychoanalysts in the first half of the twentieth century must be doubted. Early psychoanalytical studies on money all lack a sound empirical underpinning; they are based on clinical reports and case-studies, but their validity has, in most cases, never been assessed in large-scale population surveys. More systematic research on people's money-related attitudes is a recent development. Some authors attempted to provide explanations for the former lack of research on money in psychology. A number of researchers described money as a 'taboo topic' in psychology (c.f. Trachtman, 1999, Furnham and Argyle, 2000, Yamauchi and Templer, 1982). This does not mean that psychologists had some inhibition against addressing the topic of money but mainly refers to many people's reluctance towards talking about money-related issues like disclosing their income or admitting socially inacceptable money-related habits. Accordingly, doing empirical research on money, especially by means of interviews, is complicated by the fact that many people dislike talking about money. Furthermore, some researchers stressed that in the past many psychologists tended to assume that the analysis of money-related behaviour belongs to the domain of economists (c.f. Lindgren, 1999, Furnham and Argyle, 2000). A similar assertion was made by the German economist Schmölders (1982) who was very familiar with the psychological research at the time. According to him, the majority of (twentieth century-) psychologists lacked a deeper understanding of economic theory so that they hesitated to approach the presumable economic topic. Nowadays, the latter kinds of arguments sound rather obsolete. Behavioural economics and economic psychology have become widely recognised scientific branches and students enrolled in economics or psychology usually have to take seminars in the sister discipline. The rapprochement of the two disciplines in the last decades is certainly one of the reasons why money has become such a popular topic in psychology.

The present chapter introduces selected psychological literature on people's perceptions of and behaviour with money. This literature review is limited to those psychological traditions dealing with individual difference in money-related personality variables and attitudes, because the latter are of particular interest from the microeconomic perspective. Firstly the work of a number of clinicians on money pathology will be reviewed. Such a detailed consideration of the obviously constable psychoanalytical literature is considered as indispensable for this dissertation. This is because research on money attitudes in the general population, presented in the second part of this chapter, greatly draws from the reports, theories and typologies which have been developed by personality researchers with psychoanalytical background. As will become clear over the course of this chapter, the work of social psychologists interested in the topic of money consists to great extent of empirically verifying the theories and typologies proposed by clinicians.

4.1 Money pathologies

4.1.1 Psychoanalysis of money: theories and methods

Psychoanalysis was the very first psychological tradition that was applied to explore people's behaviour with money (see Goldberg and Lewis, 1978: 47). It consists of identifying and describing types of people that differ in their habits of making and using money and explaining why they do so. Psychoanalytical research on money follows theories and techniques that were originally developed by Sigmund Freud (c.f. Lea et al., 1987).

According to the Freudian perspective, behaviour is always motivated but motivations are often unconscious. Neurotic symptoms and pathological behaviour are viewed as consequences of early childhood experiences. Based on intensive research on people suffering mental disorders, Freud developed a theory of general personality characteristics (see Gerrig and Zimbardo, 2010: 515). This theory postulates that character traits are rooted in primitive biological impulses. Freud viewed adult attitudes as a product of eroticism and of obsessional beliefs people develop during childhood (see Furnham and Argyle, 2000: 133). Later on, psychoanalysts largely abandoned Freud's reasoning. They focussed less on sexual drives and on childhood experiences but highlighted the importance of social variables and experiences at all stages of life for personality development (see Gerrig and Zimbardo, 2010: 521). A similar development can also be observed when reviewing the psychological literature on money. While contemporary research focusses on circumstantial factors as the main determinants of people's money attitudes, primitive impulses and childhood experience were in the centre of debates at the beginning of the twentieth century.

Freud ([1908] 1976) propagated a first psychoanalytical theory of money in his famous article *Character and Anal Erotism*. A particularly popular element of the Freudian theory of the love of money is the symbolic equation 'money = faeces'. One may agree with Gourgé (2001) who noted that it is no wonder that psychological approaches to money have been ignored in other disciplines, and especially in economics, due to this fairly shocking notion. Other scholars stressed that it is 'somewhat strange' that the Freudian theory of the love of money 'which gave rise to many discussions and controversies among psychoanalysts and other social scientists, is almost completely ignored by economists' (Dostaler, 1997: 91).[9] Even though Freud's theory of money has been broadly ignored in other sciences, it did have considerable impact on more systematic money-related psychological research in the second half of the twentieth century. The following paragraphs therefore provide a brief summary of this theory.

As summarised by Lea et al. (1987) the main idea of the psychoanalytical approach to money consists of relating money-related pathologies to children's anal behaviour. Psychologists observed that when parents start toilet-training with their offspring the child gains, for the first time in life, some control and power over them: The child gets praise for clean defecation and can

[9] By 'almost ignored' Dostaler (1997) makes reference to Keynes whose work was evidently influenced by Freud (see also Dostaler, 2000).

provoke angry reactions of its parents by behaving inappropriately with its faeces, for example by retaining them. Freud ([1908] 1976) theorised that these two forms of anal behaviour translate into financial behaviour at later stages of life. Thrift is an unconscious outcome of the pleasure of retaining faeces and wasteful spending is related to a child's pleasure of eliminating its first possession, i.e. faeces, according to this theory. Furthermore, attraction to money stems from a child's fascination about its faeces. As noted by Furnham and Argyle (2000) the Freudian approach suggests that pathological forms of monetary behaviour stem from an early traumatisation during toilet-training. Hoarding behaviour of misers is compared to a child's refusal to defecate when asked to do so by its parents. Spendthrifts, in contrast, recall the praise they got from their parents when appropriately eliminating their faeces. They wastefully spend their money in the hope of winning other people's affection such as they experienced it when submitting themselves to parental authority. Thus, Freud's theory states that money is an unconscious equivalent of faeces and establishes a link between money and psychopathology (c.f. Trachtman, 1999).

Freud's ideas are questioned and criticised by most contemporary psychologists (see Gerrig and Zimbardo, 2010: 520). Freud never made an attempt to empirically verify the propagated effects of child rearing practise on people's behaviour with money. Still, certain components of the Freudian theory of the love of money have had considerable impact on the development of personality theories (ibid.). In the course of the twentieth century, Freud's theory of the love of money has been further developed, especially by Freud's close associate Ferenczi ([1914] 1976), and has become more plausible and acceptable than in its initial 'money=faeces' form. As summarised in Yamauchi and Templer (1982) and Yamauchi (1982) there has been always some agreement with Freud's claims among personality theorists. Many of them reported that some people feel inclined to hoard their money to overcome feelings of anxiety and of inferiority; that wealth accumulation is related to the wish of experiencing the same sense of power and respect one has experienced as a child; and that behaviour with money reflects a person's need for achievement. In the 1970s and 1980s personality theorists continued to stick to the Freudian tradition of explaining differences in people's behaviour with money as being rooted in early childhood experiences (cf. section 4.1.2). According to them, a child's relationship with its parents, learnt behaviours and taboos particularly matter for the development of attitudes towards money in later periods of life. Furthermore, and also in line with the Freudian approach, studies of pathological behaviour have been frequently used to formulate theories that explain more common behaviour with money.

4.1.2 Typologies of money pathologies

A potentially more convincing and useful concept than Freud's theory of the love of money are money-related personality-typologies. A number of psychologists made attempts to categorise people into several 'money-types'. Based on clinical observations, they investigated what money symbolises to people and how this symbolism translates into different attitudes and habits. Two frequently cited examples for money-related personality typologies are those proposed by Goldberg and Lewis (1978) and by Forman (1987). Goldberg and Lewis (1978) introduced sev-

eral money-types such as the 'compulsive saver', the 'manipulator', the 'love buyer' and the 'freedom buyer' to categorise various money-related pathologies. Forman (1987) distinguished between the 'miser', the 'spendthrift', the 'tycoon', the 'bargain hunter' and the 'gambler' to describe neurotic money-types. According to Furnham and Argyle (2000), both typologies are evidently inspired by the psychoanalytical (Freudian) approach to money. It should be noted, however, that these typologies were published in books whose titles reveal that they were written for the broad public and not exclusively for scientific purpose: *Money Madness: The Psychology of Saving, Spending, Loving, and Hating Money* (Goldberg and Lewis, 1978) and *Mind over Money: Curing your Financial Headaches with Moneysanity* (Forman, 1987). Still, these two typologies build the basis for subsequent research on money attitudes in the general population. Due to their great relevance for the development of psychometric money attitude measures the respective taxonomies will be introduced in more detail in this section.

Goldberg and Lewis' typology

Based on clinical observations Goldberg and Lewis (1978) identified four common psychological meanings of money, namely security, power, love and freedom. Security, power, love and freedom are common needs that people try to satisfy. According to the authors, many people associate these needs immediately with financial security, financial power, financial freedom and the supposed possibility to buy other people's appreciation and love. Money therefore works as a tool to fulfil these needs. Some people use money to promote or satisfy a feeling of security, for example by accumulating it (ibid: 85). Money can also be used to buy importance, domination, control and hence works as a means to acquire power (ibid: 88). Furthermore, certain people use money to overcome their feeling of being unloved by trying to buy other people's affection (ibid: 93). Finally, and maybe most plausibly, money symbolises freedom to people. Money is often seen as the means that allows people to satisfy their dreams, to buy and to do what they want to do (ibid: 96). Some people have an unusually strong want to satisfy one particular need. The exaggeration of one specific need can translate into irrational[10] habits in acquiring, spending or saving money. In the psychoanalytical tradition Goldberg and Lewis (1978) stressed that beliefs and behaviour with respect to money are rooted in unconscious infantile feelings. According to the authors, abnormal attitudes towards money are particularly likely to be found among people who have experienced emotional hardship during their childhood. For example, exaggerated needs for security and power often stem from unconscious fear of being left alone and feelings of helplessness. People who were offered gift and money rather than affection and love by their parents are more likely to develop a more intensive need for love than others. Finally, strong dependence on the parents experienced during childhood may translate into the wish to be financially independent from others, according to the authors.

[10] Like many other psychologists, Goldberg and Lewis (1978) lack to provide a proper definition of this term. Later interpretations of their book suggest that a person's behaviour should be classified as irrational when it leads to immediate neurotic gains but not to long-term satisfaction (cf. Lane 1993).

Goldberg and Lewis (1978) proposed a typology that classifies people according to the dominant meaning they attach to money and into subcategories based on their money-related habits. In the following, the four meanings of money introduced in *Money Madness* will be considered in more detail and some of the corresponding money-types[11] shall be briefly introduced.

Money as a symbol for security: Goldberg and Lewis (1978) refer to people who exaggerate their need for financial security as so-called security collectors. They describe this type of person as follows: 'Distrust is the cornerstone of the security collector – distrust of people, of the world, of the future. The possible exception is money. Money is considered the most trustworthy of all commodities; *not because one can depend on its purchasing power* but because the *possession* of it makes the anxious owner feel safer. The frightened, insecure person needs most of all to feel safe. If dependency upon parents or others in authority does not provide a feeling of protection and security, the child learns to distrust people and to seek something else to rely on. Frequently, that something else is money. If having money reduces anxiety by making the person feel less dependent on others, money may replace people as a potential source of security' (Goldberg and Lewis, 1978: 102-103, emphasis added).

Furthermore, people who see the possession of money as a form of security live in permanent fear of financial loss (ibid: 103). Fear and distrust prevent these persons from enjoying goods and services money could otherwise buy. Instead, they behave with their money in a way to fight their feelings of emotional insecurity. Often, but not always, they minimise their spending to an unusual extent and hoard as much money as possible. More precisely, Goldberg and Lewis (1978), referring to multiple case studies of patients suffering emotional insecurity, differentiate between the following three security-obsessed types:

The **compulsive saver** (cf. Goldberg and Lewis, 1978: 104-108) is the first stereotype of a security-obsessed person. Goldberg and Lewis (1978) describe the corresponding behaviour as an obsessive preoccupation with money and an illogical extreme of miserliness. The habits of the compulsive saver differ from usual saving behaviour. Money is not saved for realistic emergencies; neither is it saved for future purchases. Instead, saving money is 'an end in itself' (ibid: 104). Retaining their money makes compulsive savers feel relieved while spending money makes them anxious. In any situation, and independently of the purchase, spending money is a painful experience for the compulsive saver. Furthermore, the compulsion to save money is insatiable. The amount of money saved is never enough to make the person feel emotionally secure; the more money is acquired, the higher the fear of losing it gets. People who compulsively save their money are mostly unhappy and sometimes physically ill persons. According to the authors,

[11] Goldberg and Lewis (1978) define two to four money-types for each psychological meaning of money. These money-types are described with different degrees of precision and not all of them appear to represent an uncommon view or use of money. For example, the authors list the 'fanatical collector' as one of the stereotypes in the security category. This type of person tends to collect all kinds of items in order to satisfy his or her need for emotional security. However, it is not quite clear how money is linked to this form of pathological behaviour. For this reason, only some of the money-types, namely those who directly use their financial resources to bolster a particular feeling, will be considered in this section.

the paramount preoccupation of losing money prevents them from enjoying life. Furthermore, compulsive savers hardly have friends. Their compulsion can go as far as losing sight of their health. Although they actually have enough money, they are even parsimonious when it comes to basic needs such as nourishment and medication.

The **Self-denier** (cf. Goldberg and Lewis, 1978: 108-111) is the second pathological type within the security category. At first glance, the behaviour of the self-denier appears to be similar to compulsive saving. Like compulsive savers, self-deniers tend to neglect their personal health, are extremely thrifty in terms of personal consumption and suffer from a permanent preoccupation with saving money. Again, their saving habits are by no means rational; even in retirement self-deniers do not use up the amounts of money they have saved over the years. However, and in contrast to compulsive saving, self-denying often goes together with rather generous behaviour towards others. While self-deniers are extremely reluctant to spend money for personal consumption, they may spend even considerable sums of money on family members, friends or give it to good causes. Spending money on oneself is a painful experience because the self-denier feels guilty over exorbitantly enjoying his or her life; spending money on others, in contrast, can be enjoyed. Thus, unlike compulsive saving, the mostly miserly behaviour of self-deniers does not result from an addiction to money possession but from a feeling of guilt of personally consuming goods that money can buy. In contrast to compulsive savers, self-deniers may enjoy spending money under certain circumstances, namely when they purchase gifts for other people.

Finally, an exaggeration of the security meaning of money can translate into compulsive bargain hunting (cf. Goldberg and Lewis, 1978: 111-114). This third form of behaviour consists of extreme price awareness in combination with an ignorance of the quality or usefulness of objects purchased. The **bargain hunter** retains his or her money fiercely but spends it frivolously after having successfully negotiated the price. Satisfaction of a purchase does not relate to the commodity bought but exclusively to the amount of money saved when acquiring it (the difference between the announced price and the paid price). The bargain hunter tends to spend a lot of time looking for offers he or she considers as good deals, like products at sale. The decision of making a particular purchase is hardly motivated by a trade-off between usefulness of a commodity and its cost but linked to an exclusive consideration of price. ‘Such a person may buy six shirts at five dollars apiece and hardly ever wear them because of their poor quality rather than buy two fifteen-dollar shirts that are well-made and would look attractive for a long time. The feeling of triumph accompanying such a purchase validates the irrationality of the act’ (ibid: 112). Emotional security is thus altered by the satisfaction the person gains from making bargains.

According to Goldberg and Lewis (1978: 103), the common point of compulsive savers, self-deniers and bargain hunters is that these people find ‘a feeling of safety in money to offset a feeling of emotional insecurity’. Compulsive savers fight their feelings of emotional insecurity by hoarding money. Self-deniers bolster their feelings of safety by abstaining from spending money on personal consumption. Bargain hunters do so by spending money on products which are reduced in price. The authors also highlight that the individual security-oriented money-types are

not mutually exclusive. Persons that suffer from emotional insecurity frequently show characteristics of more than one type. Thus, it is possible that a person tries to minimise his or her expenditures to an unusual extent but occasionally spends huge sums of money on things that are on sale or on gifts.

Money as a symbol of power: Power-oriented people feel strong and powerful when having and spending a lot of money. Losing money, on the other hand, makes them feel weak and helpless (see Goldberg and Lewis 1978: 26). According to Goldberg and Lewis (1978: 27) so-called power grabbers have trouble in dealing with others, they tend to react 'mechanically or superficially' towards their social environment. A common characteristic of power grabbers is their wish to dominate people in their social sphere and to explore the weaknesses of others while at the same time denying any kind of personal weakness. Money serves them as a means to control and dominate other people. The authors describe, for example, the following personalities within the group of people who share an irrational view on money as a source of power:

The **manipulator** (cf. Goldberg and Lewis, 1978: 127-136) tends to take advantage of others, breaks promises or even lies to get more money without feeling any guilt about these socially undesirable forms of behaviour. By breaking social rules many manipulators become quickly powerful and wealthy, but their need for even more power and more money is hardly ever satisfied. Because of their permanent drive for financial power many people within this group do not only break social rules but also laws. Manipulators are mostly unable to form social relations and often become lonely and unhappy when they grow older.

A second type of person who strives for power is the so-called **empire builder** (cf. Goldberg and Lewis 1978: 136-142). The authors describe empire builders as aggressive and ambitious people but, in contrast to so-called manipulators, they operate within social rules and laws in their struggle for financial power. They have an 'overriding sense of independence and self-reliance' (ibid: 136). Empire builders are described as hard workers who prefer to be leaders rather than followers. They acquire money, property and other resources to become more powerful. A filled bank account, business and estates help the empire builder to fight his or her feeling of helplessness. However, satisfying one's need for power comes at the cost of work obsession, isolation and a lack of time and opportunities to enjoy one's fortune. As in the case of most other money-types, the behaviour of manipulators and empire builder appears to be irrational because it yields no long-term satisfaction. The need for financial power will be never satisfied but increases the more money these people dispose of and spend.

Money as a symbol for love: Some people associate money with love. These people use money to overcome their feelings of being unloved and to express their love towards others. Love-starved people try to please others by being generous. They feel loved when receiving money from others, while not obtaining financial rewards is interpreted as a sign of not being loved. Same as in the case of other money-types, the financial habits of people who associate money

with love are, according to Goldberg and Lewis (1978), rooted in early childhood experiences. Children learn early that money can buy desirable things and therefore quickly associate money with pleasure. Since children tend to think that their parents' money supply is unlimited, they often interpret their parents' refusal of giving them money as a sign of punishment and a lack of love. When they grow older most children learn that love cannot be bought and sold, however, some people never stop making the association of love and money. Goldberg and Lewis (1978) describe several stereotypes of so-called love dealers, among others the following two types:

Lover buyers (cf. Goldberg and Lewis, 1978: 161-166) use money as a means to make other people happy. By being generous they try to buy other people's affection and recognition. For example, love buyers often make large contributions to charity in the hope of gaining the admiration of recipients and of their social environment. They insist on paying the check at the restaurant and give large tips to waiters. Spoiling one's children with monetary rewards and expensive gifts is another exemplary behaviour of the love buyer personality. Other people often exploit this generosity; love buyers frequently become victims of 'manipulators and unscrupulous salesmen' (ibid: 165).

People who feel unloved but lack sufficient financial resources to buy other people's affection are classified as **love stealers** (cf. Goldberg and Lewis, 1978: 173-178). These people often suffer a compulsion to steal money. Among other examples, the authors describe the case of an employee who felt unappreciated by his boss and started stealing money from the company to fight his feeling of being unlovable. The tragedy of love buyers, love stealers and other money-types in the group of people who associate money with love is that their need for love is never satisfied, irrespective of how much money they spend, obtain or steal.

Money as a symbol for freedom: The last common meaning of money listed in *Money Madness* is freedom. People who associate money with freedom have in common that they worship autonomy and financial independence. However, the struggle for autonomy and financial independence can take very different forms. The first stereotype that Goldberg and Lewis (1978) introduce is the freedom buyer (cf. Goldberg and Lewis, 1978: 187-192) who accepts that making and saving money is necessary to achieve a certain degree of autonomy to fulfil one's needs and dreams. The second type is the freedom fighter (ibid: 187-199) who rejects the importance of money and society's worship of money.

Freedom buyers see the accumulation of money as a means to buy the things they wish to possess and to do the things they enjoy doing. Money gives the freedom-seeking person the feeling of not having to depend on others' favour or on a regular job, once he or she has accumulated sufficiently large amounts of money. In some cases, the desire for independence can take extreme forms; some freedom buyers take high risks to obtain money and often experience significant financial loss.

Freedom fighters are the 'anti-money contingent' (ibid: 192) of the population; they consider money and material possession as unimportant. Goldberg and Lewis (1978) put several political

and social groups into this category; among others they list communists, socialists, adherents of the commune movement and revolutionary. Freedom fighters often come from privileged families but motivations underlying the rejection of money (e.g. a high income) and material possession differ. Goldberg and Lewis (1978) mention the rejection of one's parents' lifestyle as one reason and feelings of guilt about one's own affluence as another. According to the authors, the rejection of money is rarely a lifelong attitude but weakens or disappears as people grow older and become more conservative.

Goldberg and Lewis (1978) referred to several case studies to illustrate the behaviour of the different money-types. Furthermore, they provided a list of statements revealing an 'irrational use or view of money' (ibid: 100-101). Based on this list, readers can self-diagnose whether they suffer from pathological money-related syndromes or not. In this list, the habits of security collectors are, for example, described by the following statements referring to several money-related behaviours within this group: 'You buy things you don't need or don't want because they are on sale' and 'You feel compelled to argue or complain about the cost of almost everything you buy' are forms of behaviour that are typical for bargain hunters; 'Even when you have sufficient funds you feel guilty about spending money for necessities such as a new pair of shoes' and 'You automatically say, 'I can't afford it,' whether you can or not' reflect the habits of compulsive savers. Other statements such as 'You use money as a weapon to control or intimidate those who frustrate you' reflect the behaviour of power-oriented people. 'You insist on paying more than your share of restaurant checks or bar bills just to be appreciated or to make sure that you do not feel indebted to anyone' refer to the behaviour of love buyers. Interestingly, none of the statements listed by Goldberg and Lewis (1978) seem to relate to the freedom meaning of money. Based on the fact that freedom-oriented people are left out in the list of examples which point to 'an irrational use of view of money' (ibid: 100) it can be speculated that the authors themselves considered the association between money and freedom as rather common and less irrational than viewing money as a symbol for security, power and love.

Forman's typology

The Canadian psychologist Forman (1987) developed another often cited typology for neurotic behaviour with money thereby classifying people in terms of five stereotypes, namely misers, spendthrifts, tycoons, bargain hunters and addictive gamblers. Following his American colleagues, Forman (1987) explained the existence of disordered money beliefs and behaviours by emotional connotations people have with money. According to the author, money represents, in addition to the goods and services it can buy, love, self-worth, freedom, power and security. A healthy way of relating to one's money (i.e. income and wealth) is, according to the author, to value money for merely the things it can buy (see Forman, 1987: 5). Neurotic behaviour with money, by contrast, is particularly widespread among people who value their money for the psychological needs it represents (love, power, etc.). Just like Goldberg and Lewis (1978), Forman (1987) developed questionnaires that should help his readers to self-diagnose their money-related

problems. Forman's (1984) questionnaire consists of several 'Money Pathology Scales' referring to five neurotic money-types he described in his book. The five neurotic money-types introduced in *Mind over Money* as well as examples for the corresponding sets of self-diagnose statements shall be briefly presented now.

Misers are extremely stingy people and this meanness is related to the security meaning people attach to money. Possessing money helps the miser to reduce his or her feelings of anxiety; spending money puts the miser in states of fear and panic (see Forman, 1987: 7). Misers tend to be extraordinarily preoccupied with money-related issues and to compulsively hoard their money. They are exaggeratedly anxious of losing funds or being taken advantage of in situations involving money. Furthermore, they are hardly able to enjoy their purchases and other benefits they could obtain when spending their money (ibid: 17). Like other neuroses, miserliness is rooted in early childhood experiences, according to Forman (1987). Children who feel weak and dependent during their childhood start to accumulate money in their piggy banks which makes them feel stronger, more powerful and less anxious. A miser is supposed to agree with statements like 'One of my greatest pleasures with money is saving it all the time. I really hate to spend any of it' (ibid: 12); 'I often hold on to funds rather than spend them, even though there is no particular reason to do so'; and 'I have terrible fear of losing funds and of being taken advantage of financially' (ibid: 20-21).

Emotional connotations of money with security and love sometimes translate into compulsive bargain hunting. **Bargain hunters** gain satisfaction from outsmarting sellers and paying a lower price for a purchase than other people did (see Forman, 1987: 47). Bargain hunters enjoy the thrill they get from negotiating the price but tend to overlook the quality and usefulness of the things they purchase. They interpret a seller's act of lowering the price as a sign of care and love, which are things that bargain hunters typically missed during their childhood. Symptoms of this second money neurosis are reflected by the following exemplary statements: 'When I buy something, I look for the best bargain I can get, even if the workmanship is not great' (ibid: 43); 'When I shop, I must feel that I'm saving money and that the price was less than usual'; and 'I can't resist a sale of almost any kind and I often end up buying things just because they are bargains. Many of these purchases get little or no use' (ibid: 49).

Spendthrifts enjoy the act of spending money for its own sake (c.f. Forman, 1987: 29). Due to their compulsive spending behaviour they are unable to put any money aside and are likely to run into debt, irrespective of their incomes. Similar to bargain hunters, spendthrifts often end up with purchases they neither need nor use. They spend money on things for themselves and expensive gifts for others in order to contain feelings of anxiety they have developed in early childhood. Usually, spendthrifts have low self-esteem, are anxious and make themselves dependent on others by borrowing money (ibid: 29). People who were (financially) spoilt and overprotected by their parents are particularly likely to develop the spendthrift symptoms. Also, children who receive little money and miss their parents' affection may become spendthrifts in their later life. Statements applying to a stereotypical spendthrift include 'At the end of the

month I am always in debt' (ibid: 24) or 'I can't stop myself from spending, even though I feel guilt or shame afterwards' (ibid: 32).

So-called **tycoons** are obsessed with making money. They are workaholics who are fascinated about watching their fortune increasing (see Forman, 1987: 39). Other people often praise them as money-making genies so that tycoons seldom recognize that their money-building behaviour is obsessive. Tycoons are, according to Forman (1987), often driven by the power symbolism of money; the accumulation of money gives them a feeling of superiority which is reinforced by the admiration they receive from others. Similar to misers, having money is more important than spending it for tycoons. As other money pathologies, obsessive money making is assumed to be the outcome of early childhood experience. Forman (1987) provides the example of the son of a successful business father who overtook his fathers' habit to sacrifice family life on behalf of the business. This person has always been fascinated about the idea of building his own fortune and to become more affluent than his father (ibid: 38). A tycoon would agree with statements like 'I am not very interested in spending money but I love to amass it'; 'Even when I have more money than I need, I still work at increasing my stockpiles' and 'Money is the best way to gain power, status, and approval' (ibid: 40-41).

The last money-related neurosis discussed by Forman (1987) is addictive gambling. In contrast to people who occasionally gamble for enjoyment or those who earn a living with it, the **compulsive gambler** is an addict who believes that he or she can control the probability of winning and who experiences unusual exhilaration by taking risks (ibid: 54-55). Unlike in the case of other money-types, the author neither clearly states which of the different connotations with money (power, love, etc.) may be responsible for this psychological problem nor does he relate compulsive gambling to early childhood experiences. Statements which presumably describe the personality of a compulsive gamblers are, for example, 'Placing a bet makes me feel exhilarated and optimistic' and 'When I gamble I feel a sense of power, as if each win is a major victory' (ibid: 57).

4.1.3 Discussion

When comparing the two typologies presented in section 4.1.2 a reader will discover several similarities. Goldberg and Lewis (1978) and Forman (1987) all have psychoanalytical background. They developed their taxonomies based on their clinical experience with clients from the middle-class, following the psychoanalytical tradition of explaining neurosis with early childhood experiences and provided questionnaires their readers can use to self-diagnose whether or not they suffer from money-related pathologies. The terminology and the description of the different forms of money-related behaviours are also very similar in both books. Forman's (1987) miser resembles the compulsive saver described by Goldberg and Lewis (1978); spendthrifts can be viewed as the opposite pole of misers or compulsive savers and also resemble, to at least some extent, so-called love buyers. Tycoons resemble the money-types described by Goldberg and Lewis (1978) in the group of power-oriented people. The bargain hunter is a money-type which appears in both typologies and addictive gamblers bring to mind Goldberg and Lewis'

(1978) freedom fighter who tends to take huge risks to satisfy his or her need for financial autonomy. Other taxonomies, including older and updated variants developed based on clinical data collected in different cultures and countries (e.g. Kaufman, 1956, Mellan, 2001, Furnham, 2014), encompass very similar money-types, too. These additional typologies will not be further considered in this dissertation; however, it is interesting to observe that certain money-types appear in virtually all published taxonomies. This overall resemblance indicates that the two typologies presented above are, to at least some extent, accurate and relevant. Money-types like misers, spendthrifts and power-obsessed money-makers have been identified based on independent clinical data by several personality theorists from different countries.

One may agree with Furnham and Argyle (2000) who described personality typologies as useful for the simplification of complex processes of human behaviour. This argument especially holds for the analysis of money-related behaviour. The two personality typologies cited in this chapter point to a number of reasons why people strive for money, why some people spend it in rather unusual ways and why others fiercely retain it. Goldberg and Lewis (1978) and Forman (1987) brought together many money-related patterns that are well-known from everyday observations. When thinking of one's family, friends and colleagues there are doubtlessly some cases of people who fanatically hoard their money, who spend an unusual amount of their time looking for bargains, people who permanently try to appear generous and also some idealists who deny the importance of money. From the economic perspective the description of multiple stereotypes is enlightening because the typologies point to the issue that the meaning of money and people's behaviour with it appears to be more complex than economic theory suggests. However, the role that money plays for the money-types described in the typologies and the degree to which a money-type's view of and behaviour with money contradicts the economic concept of money differ. The behaviour of several money-types, including the self-denier, the manipulator, the love buyer and the freedom-seeker, is relatively similar to what economic theory suggests. In many instances money appears as a means to an end, as a token to buy other things like gifts, material possessions or time which helps a person to satisfy their feelings of insecurity, vulnerability, dependence or of being unloved. For some groups, for example compulsive savers, misers and maybe also empire builders and tycoons, however, the accumulation of money appears to be an end in itself. There is no space for such money-types in standard consumer theory because for the rational individual money is worth only the things it can buy.

At the same time, the usefulness of money-related personality typologies for the prediction of financial behaviour can be questioned. The common characteristic and the biggest shortcoming of the research on money pathology, including Freud's theory of money and the work of personality theorists, is that the existing theories and personality typologies were formulated based on clinical case studies only. These case studies are, of course, not representative for the general population. In the literature reviewed in this section, the common practise consists of describing and documenting extreme cases, which are interesting and memorable but probably rather exceptional. Pathological uses of money, such as miserliness or obsessive spending, are likely to be

rather extraordinary cases of financial behaviour and it can be doubted that they matter at a macro level (see Furnham and Argyle, 2000: 151). The psychoanalytical literature gives no insights how likely pathological uses of money are to occur in a society, in other words whether they matter for the prediction of financial behaviour in the general population or not (ibid.). Furthermore, due to the strong impact of Freud's writings on money, psychoanalytically-orientated authors tend to trace all money-related problems back to early childhood experience, thereby neglecting situational factors such as the social, cultural and economic environment of a person (ibid.). In fact, the impact of child rearing practice on money-related pathologies like miserliness seems to be rather unimportant compared to other factors, as shown in a recent study by Hur et al. (2011).

As mentioned previously, *Money Madness* and *Mind over Money* were written for the broad public rather than for scientific purpose. A reader may perceive Goldberg and Lewis' (1978) and Forman's (1987) popular writing styles and their approach to categorise several forms of unusual money perceptions and money-related behaviour as fanciful but superficial. The selection of the particular money-types which are described in detail often appears somewhat random. In addition to that, the degree of precision in defining and describing the different types greatly varies. For example, while Goldberg and Lewis (1978) dedicated nine pages of their book to the description of the power-obsessed manipulator but merely five pages sufficed to depict the freedom buyer. It remains, however, an open question whether those types which are treated rather briefly are as relevant as the more carefully portrayed money-types.

Certainly, the existence of money pathologies in the general population can be expected to be rather low, but the actual share of certain neurotic money types is not specified in the corresponding literature. However, the authors of money-related typologies provided questionnaires which might be useful measures to identify neurotic money-types like misers or tycoons in the general population. Still, these questionnaires are also merely based on clinical experience and were not psychometrically validated by their authors. Hence, key criteria for the validity of a psychometric inventory, for instance sufficiently high correlations between statements referring to one particular money-type, may be not fulfilled in the case of these questionnaires. This concern was partly confirmed in a study conducted by Furnham (1996) who made an attempt to validate Forman's (1987) five money-type questionnaires. The questionnaires that had been formulated to identify misers, bargain hunters, spendthrifts, tycoons and gamblers were filled in by 180 representatively selected subjects. The survey data was then analysed statistically in order to verify whether the five money-types could be adequately measured, i.e. whether the items referring to one money-type were sufficiently correlated. Based on the results of an explanatory factor analysis, Furnham (1996) concluded that the gambler- and spendthrift-subscales showed good internal consistency, but he reported considerable overlap between the miser- and the bargain hunter-subscales. Furthermore, the tycoon-items were ambiguously correlated with several items of the other factors. Furnham (1996) explained the overlap between the miser and the bargain hunter constructs by the poor psychometric properties of the inventory. At the same time, this

overlap is in line with one of Goldberg and Lewis (1978) observations: Miserliness and bargain hunting are not mutually exclusive but belong to the same category of money-related pathologies, namely the category that refers to the security meaning of money.

Finally, it is to be noted that from an economist's point of view, the word 'money' is often employed in a misleading way in psychoanalytical literature. To be more precise, Goldberg and Lewis (1978), Forman (1987) and other psychologists should have replaced the word 'money' by income or wealth in many cases. For instance, so-called tycoons are certainly not obsessed with filling their piggy bank with notes and coins but strive for high incomes. Furthermore, freedom-fighters would probably not favour the idea of abolishing money as a means of payment but criticise other people's obsession with earning high incomes and condemn the unequal distribution of wealth.

In spite of the criticism which can be directed towards psychoanalytical theories and typologies on money-related behaviour, they give some interesting insights into people's money-related emotions and habits. A remarkable point made by psychoanalysts is that money is not only a neutral means of payment but also an emotionally laden object that influences people's behaviour (c.f. Belk and Wallendorf, 1990). For some people spending is accompanied by strong feelings stemming from the pure act of giving away money. Goldberg and Lewis' (1978) compulsive saver and Forman's (1987) miser appear to be useful personality categories that explain some of the irrationalities in people's every-day behaviour with money. Individual differences in people's general disposition to spend money may explain why some rich people are extremely stingy, why people get satisfaction from looking at their cash balances, although they do not plan to deplete them or why some childless old people live poor and die wealthy. Furthermore, as will be argued in chapter 5, individual difference in the general disposition of spending money may also explain respondents' answers to willingness to pay questions in survey-based environmental valuation studies. Finally, as shown in the next section, Freud's psychoanalytical theory of money and Goldberg and Lewis' (1978) typology have had a considerable influence on concepts developed in other psychological disciplines, especially when it comes to the measurement of money-related attitudes in surveys.

4.2 Measurement of money attitudes

4.2.1 Money attitudes: definition and development of inventories

Whereas the psychoanalytical approach to money mainly consists of observing, describing and explaining money-related personality traits and attitudes, social psychologists and psychometricians are interested in measuring these variables of individual difference in surveys (see Furnham and Argyle, 2000: 44). The topic of money has entered survey research through the investigation of personality traits and attitude testing. Personality traits are characteristics of a person; they manifest themselves in consistent patterns of behaviour across different situations (see Gerrig and Zimbardo, 2010: 507). An attitude can be defined as favour or disfavour towards an 'attitude objective', i.e. a person, an item or beliefs. In psychology, three components of an

attitude towards an attitude object are usually considered: an affective, a behavioural and a cognitive component (the 'ABC model'). The affective component is about the feelings a person has concerning the attitude object; the behavioural component is related to a person's behaviour with the attitude object; and the cognitive component of an attitude refers to a person's beliefs when reminded of the attitude object in question (ibid.). Like personality traits, attitudes are not directly observable and sometimes people are not aware of their attitudes. Still, attitudes can influence a person's behaviour (ibid.). Compared to personality traits, attitudes are less stable because they are often influenced by situational and circumstantial factors (c.f. Stumm et al., 2013).

Even though personality traits and attitudes are conceptually different variables, personality research and attitudinal research frequently overlap when it comes to the statistical analysis of people's beliefs and behaviour with respect to money. Most survey-based studies on money look at the relationship between personality and money-related attitudes rather than exclusively focussing on the one or the other concept. In spite of its direct relationship with personality research, the psychological work on money which employs quantitative methods is often simply summarised under the name of 'money attitudes' (see e.g. Furnham and Argyle, 2000). Stumm (2013: 344) defines money attitudes as 'individual differences in the motivation for obtaining and spending money'. This definition leaves room for interpretation since it does not unambiguously state whether the motivation for obtaining and spending money is a stable personality trait or affected by situational and circumstantial factors. In the following the common terminology is overtaken, i.e. the term 'money attitudes' (or 'attitudes towards money' respectively) will be used to describe or stable personality traits or more context-dependent attitudes.

Since the 1980s, a number of self-report questionnaires have been constructed in order to measure money attitudes. These inventories help to capture people's perception of money and their behaviour with money, i.e. how they acquire, spend and save it. When developing a new money attitude inventory, psychologists typically collect a number of statements referring to people's perception of money, their money-related emotions and financial habits from different sources. These sources include, for example, clinical reports, money-related personality typologies and already existing attitude inventories. In many cases, clinical literature and especially the theories and typologies developed by personality theorists with psychoanalytical background have served as a key reference for the collection and formulation of different items (see e.g.Yamauchi and Templer, 1982, Furnham, 1984, Furnham et al., 2012). In the succeeding step researchers develop a questionnaire containing these items and empirically test it, by asking survey participants to express their personal agreement with the money attitude statements on rating scales, so-called Likert scales. Subsequent to the survey, statistical methods, most prominently explanatory factor analysis, are employed in order to determine correlations between several statements and to define a number of dimensions or facets of the money attitude construct. Ideally, these sub-constructs reflect the theoretical concept proposed in the sources from which the different statements have been extracted. For example, a researcher who wants to develop an inventory to measure the money attitudes of security-orientated and power-obsessed people

hopes to obtain a statistical outcome which reflects a security and a power dimension. However, in many cases the results of the factor analysis do not exactly reflect the theoretically defined money attitude dimensions. Psychometricians typically interpret the statistically defined factors and give them names which resemble the theoretical terminology (power, security, etc.). The items encompassed by each factor then form a subscale measuring a particular dimension of money attitudes. The authors of a money attitude scale typically conduct validity and reliability tests of the subscales in the initial study. All subscales which pass the consistency check are kept within the overall inventory and can be used by other practitioners to empirically measure the corresponding money attitude facet. Hence, what is commonly described as a particular money attitude or a facet of money attitudes is a theory-based but in the end statistically defined construct.

In the following sections, the three most frequently used money attitude measures which are Yamauchi and Templer's (1982) 'Money Attitude Scale', Furnham's (1984) 'Money Beliefs and Behaviour Scale' and Tang's (1992) 'Money Ethic Scale' will be introduced. In addition to that, a more recently developed money attitude measure, namely Klontz et al.'s (2011) 'Money Script Inventory' will be presented and discussed.

4.2.2 Overview of existing measures

One of the best-known instruments for the measurement of money attitudes is the **Money Attitude Scale** (MAS) developed by Yamauchi and Templer (1982). The MAS consists of 29 items referring to a person's habits in spending and saving money. Survey participants rate these items on a 7-point Likert-type scale with 'always' and 'never' as endpoints. The MAS was conceptualised and based on the writings of psychoanalysts and personality researchers. Yamauchi and Templer (1982) adopted several concepts from the psychoanalytical literature on money; items of the scale refer to viewing money as a source of security, pathological money retention and using money to acquire power and status. The initial survey was carried out in Los Angeles and Fresno, California. 300 voluntary subjects took part in this survey. An explanatory factor analysis of the data revealed four clear factors of money attitudes: *Power-Prestige*, *Time-Retention*, *Distrust* and *Anxiety*. The dominant factor[12], *Power-Prestige*, encompasses items pointing to the habit of using money to impress and manipulate others and to viewing one's income and wealth as a sign of success (e.g. 'I use money to influence other people to do things for me'; 'I must admit that I purchase things because I know they will impress others'; 'I must admit that I sometimes boast about how much money I make'). *Time-Retention* consists of items referring to a person's saving habits and concern for future financial security (e.g. 'I do financial planning for the future'; 'I put money aside on a regular basis for the future'; 'I save now to be prepared for my old age'). Items belonging to the *Distrust* dimension of the MAS refer to a hesitating and suspicious purchasing behaviour (e.g. 'I argue or complain about the cost of things I buy'; 'I

[12] In a factor analysis factors are ordered according to their eigenvalues. The dominant factor is the one with the highest eigenvalue and it explains most of the total variance in all the variables included in the factor model.

automatically say, 'I can't afford it,' whether I can or not'; 'I hesitate to spend money, even on necessities'). The last sub-construct, *Anxiety*, contains items referring to a compulsive need to spend money ('It's hard for me to pass up a bargain'; 'I spend money to make myself feel better') and also items describing worries linked to fears of lacking money ('I show signs of nervousness when I don't have enough money'; 'I worry that I will not be financially secure'). Based on these four factors, subscales of five to nine items were defined in order to measure the four facets of money attitudes. The four subscales showed adequate internal consistency[13]; the authors reported a Cronbach's alpha of 0.80 for the power-subscale, 0.78 for the retention-subscale, 0.73 for the distrust-subscale and 0.69 for the anxiety-subscale. A test-retest comparison confirmed the psychometrical soundness of the MAS and its subscales. Yamauchi and Templer (1982) tested the validity of the MAS by relating the four facets to several psychological constructs that appeared to be similar to *Power-Prestige*, *Time-Retention*, *Distrust* and *Anxiety*. For instance, all four facets were positively related to status concern and two of them, namely *Time-Retention* and *Distrust,* were positively correlated with the personality trait obsessionality. Furthermore, the authors highlighted that none of the four attitudinal facets was essentially correlated with a person's income. Over the last three decades, the full MAS or selected MAS-subscales have been used in many empirical studies. The measure was translated into several languages and was used in different countries. Many studies confirmed its structure but quite often the *Distrust* and the *Anxiety* facets were highly correlated and interpreted as one single facet (cf. Medina et al., 1996). In spite of its advanced age the MAS still enjoys the reputation of a reliable and valid instrument for measuring money attitudes (cf. Wiepking and Breeze, 2012, Durvasula and Lysonski, 2010).

Another widely used psychometric measure is Furnham's (1984) **Money Beliefs and Behaviour Scale** (MBBS). Furnham (1984) constructed the MBBS two years after the MAS thereby explicitly referring to the 'shortcomings' (ibid: 502) of the latter measure: 'Although the authors [Yamauchi and Templer (1982)] obtained a large and fairly heterogeneous sample they failed to investigate any demographic differences (…). Secondly, their partial validation seemed overconcerned with psychopathological correlates of money attitudes rather than on normal social beliefs and attitudes. Finally, the study makes no attempt to trace the aetiology of these beliefs' (Furnham, 1984: 502). The MBBS is an inventory of 60 items that respondents rate on a 7-point Likert scale with 'disagree' and 'agree' as endpoints. Furnham (1984) assembled these items from three sources, namely Yamauchi and Templer's (1982) MAS, attitude statements listed in Goldberg and Lewis (1978) book on *Money Madness* (cf. section 4.1.2) and on a questionnaire on money perceptions developed by Rubenstein (1981, cited in Furnham and Argyle, 2000: 45-47). Unlike the MAS, the MBSS does not only contain behavioural statements but also money belief statements (e.g. 'I firmly believe that money can solve all my problems'; 'I believe that

[13] Internal consistency or reliability is commonly assessed with Cronbach's alpha. The alpha provides an estimate that indicates how well the items form a common unit. It can range from 0 to 1; the higher the alpha, the greater is the internal consistency of the scale. A scale used for group comparison should have an alpha of at least 0.5 (cf. Switzer et al., 1999).

money is the root of all evil'). The initial survey was carried out in Great Britain. Furnham (1984) surveyed 256 subjects differing in their socio-demographic characteristics, voting patterns and religious affiliation. Factor analysis yielded six interpretable sub-constructs: *Obsession*, *Power/Spending*, *Retention*, *Security/Conservative*, *Inadequate* and *Effort/Ability*. Although the labels of the factors recall Yamauchi and Templer's (1982) findings, the composition and interpretation of the subcontracts is mostly different. The dominant factor, *Obsession*, encompasses statements referring to an unusual importance a person attaches to 'all aspects of money' (Furnham, 1984: 503): 'I feel that money is the only thing that I can really rely on'; 'I am proud of my financial victories – pay, riches, investments, etc. – and let my friends know about them'; 'I would do practically anything legal for money if it were enough'. *Power* contains items that reflect a person's habit to spend money on status symbols or to use it to acquire importance (e.g. 'I sometimes buy things that I don't need or want to impress people because they are the right things to have at the time'; 'I sometimes 'buy' friendship by being very generous with those I want to like me'). Items reflected by the *Retention* factor exclusively belong to Goldberg and Lewis' (1978) list of statements referring to pathological penny pinching (e.g. 'I often say 'I can't afford it' whether I can or not'; 'Even when I have sufficient money I often feel guilty about spending money on necessities like clothes etc.'; 'I often have difficulty in making decisions about spending money regardless of the amount'). In contrast to this neurotic tendency to retain one's money *Security/Conservative* contains statements describing more coherent attitudes towards saving (e.g. 'I always know how much I have in my saving account'; 'I am proud of my ability to save money'). Statements belonging to *Inadequate* reveal a person's feeling of lacking money, especially in comparison to his or her reference group (e.g. 'Most of my friends have more money than I do'; 'The amount of money I have saved is never quite enough'). Finally, *Effort/Ability* describes whether or not a person perceives his or her wage or salary as fair (e.g. 'I believe that my present income is about what I deserve, given the job I do'). Furnham (1984) reported several correlations of the six facets of money attitudes with demographic and socio-economic variables. Among other things, a respondent's age had a significant impact on four out of five money attitudes: Older respondents reached higher scores on the *Power*, the *Retention*, the *Security* and the *Effort/Ability*; income was positively correlated with *Obsession*, *Power* and *Effort/Ability*. Furthermore, education showed very similar relationships as income. Appropriate levels of internal consistency were reported for the overall scale. Furnham (1984) reported an alpha of 0.84 for the overall instrument; in a follow-up study Wilhelm et al. (1993) found alphas ranging from 0.75 to 0.82 for the individual subscales. The six factor structure obtained from the initial survey was reproduced in further empirical applications of the MBBS, confirming the reliability of the inventory. Instead of employing the full set of items, several studies used only selected subscales of the MBBS to measure particular facets of money attitudes. In empirical application the *Obsession* sub-construct enjoys particular popularity. An often cited example is a cross-cultural study of money attitudes by Lynn (1992). This study explored people's importance attached to money, income and wealth in 43 countries using Furnham's (1984) *Obsession* sub-

scale. Just as the MAS, the MBBS has been used extensively during the last three decades, and also in recent studies (cf. e.g. Wiepking and Breeze, 2012).

A third frequently used money attitude inventory is the **Money Ethic Scale** (MES) (Tang, 1992). Tang (1992) generated several money attitude statements based on the psychoanalytical literature on money (money a means to satisfy different needs, see section 4.1), a survey by Wernimont and Fitzpatrick (1972) who aimed at determining how the concept of money is perceived by different groups of the population, as well as the money attitude inventories developed by Yamauchi and Templer (1982) and Furnham (1984). In the initial study, 249 subjects with full-time work experience completed a 25-page questionnaire encompassing a long list of money-related statements. The final measure consists of 30 items that respondents answer on a 7-point agree-disagree Likert scale. The MES encompasses six facets which Tang (1992) labelled *Good*, *Evil*, *Achievement*, *Respect*, *Budget* and *Freedom*. The dominant factor *Good* contains mainly items describing people's feelings when thinking of money and reveals positive associations people have when thinking of the concept of money (e.g. 'Money is good' and 'Money is important'). In contrast to that, the second factor (*Evil*) reveals negative emotions (e.g. 'Money is the root of all evil'). *Achievement*, *Respect* and *Freedom* reflect certain associations with money (e.g. 'Money represents one's achievement'; 'Money makes people respect you in the community' and 'Money gives you autonomy and freedom'). *Budget* is the only factor referring to a person's behaviour with money. High scores on this factor point to a rather prudent approach when it comes to spending money (e.g. 'I use my money very carefully'). The scale showed adequate internal consistency (Cronbach's alpha for each of the subscales reached from 0.71 to 0.81). Correlations of the six factors with demographic variables and personality variables as well as plausible correlations with economic, political and religious values confirmed the validity of the MES and its sub-constructs. The questionnaire was translated into several languages and applied in empirical studies around the world. Du and Tang (2005), for example, conducted a survey in mainland China, Tang and Chiu (2003) used the MES in Hong Kong and Tang et al. (2000) carried out a cross-cultural comparison of money attitudes. A considerable number of empirical studies employing the MES have focussed on linking money attitudes to work-related concepts such as job and pay satisfaction, helping behaviour and unethical behaviour at the workplace (e.g. Tang and Chiu, 2003, Tang and Gilbert, 1995, Liu and Tang, 2011). Several empirical studies confirmed the factor structure of the MES. Hence, the reliability of the scale and its validity in measuring a multidimensional construct referring to the concept of attitudes towards money was repeatedly confirmed. Nevertheless, Tang and his associates also presented several modifications of the MES. In recent times Tang and colleagues have abandoned working with the complete MES and focused on the 'Love of Money Scale' instead (Tang and Chiu, 2003), which is a subscale of the MES. Hence, compared to the two older money attitude inventories, Yamauchi and Templer's (1982) MAS and Furnham's (1984) MBBS, the MES has been modified to a considerably larger extent. The reformulation of individual statements, the elimination of certain items and the refinement of the money attitude facets may have led to a continuous improvement

of the scale. At the same time, the permanent modification of the inventory might also point to a lack of consistency and accuracy of the overall measure. It is also to be noted that Tang himself was involved as a co-author in virtually all published studies which employed a variant of his original money attitude scale. Hence, the quality of the inventory cannot be judged very easily.

More recently, Klontz et al. (2011) proposed an instrument to measure disordered money beliefs. These authors developed the **Klontz-Money Script Inventory** for studies in the clinical context to 'assess potentially problematic attitudes of clients that may interfere with accomplishing financial goals' (Klontz et al., 2011: 17). The items of the inventory stem from clinical observations along eight themes: money worship, anti-rich, money is bad, money mistrust/openness, frugality/fiscal responsibility, money anxiety, money status and money is unimportant. 422 respondents took part in a web-survey and rated 72 money-statements on a six-point disagree-agree Likert scale. The authors found four clearly interpretable factors that they labelled *Money avoidance*, *Money worship*, *Money status* and *Money vigilance*. The dominant factor *Money avoidance* reflects a tendency to negate the importance of being wealthy (e.g. 'Rich people are greedy', 'Good people should not care about money'). *Money worship* points to positive attitudes towards having 'more money' and viewing money as a source of happiness (e.g. 'Things would get better if I had more money'; 'More money will make you happier'). *Money status* encompasses statements that reflect a person's association of people's wealth and income with status and success (e.g. 'Most poor people do not deserve to have money'; 'Money is what gives life meaning'). Finally, *Money vigilance* contains a set of items that indicate whether a person wants to keep his or her money issues private and also the importance somebody attaches to being financially prepared for the future by saving money (e.g. 'You should not tell others how much money you have or made'; 'Money should be saved not spent'; 'I would be a nervous wreck if I did not have money saved for an emergency'). According to the authors, a high score on the *Money vigilance* scale reveals an approach to money that encourages saving and frugality and may also reflect excessive levels of anxiety regarding financial danger. The authors reported high levels of reliability of all four subscales (Cronbach's alpha ranged between 0.70 and 0.84 for the four subscales) and found several correlations between the four factors and other variables. Interestingly, while the first three factors were correlated with several socio-demographic characteristics of the respondents, including age, ethnicity, education and income, *Money vigilance* showed no relationship with any of these variables.

As highlighted by Klontz et al. (2011) their inventory serves as an update to the MAS (Yamauchi and Templer, 1982) and the MBBS (Furnham, 1984). Besides being more topical than the MAS and MBBS, little can be said regarding the quality of this recently developed measure. In spite of articles referring to the initial survey study, no further empirical application of the inventory has been published yet. Still, some conclusions can be drawn from Klontz et al.'s (2011) work: Three out of the four sub-constructs of the scale are similar to those that have been identified in the 1980s. *Money worship* is similar to Furnham's (1984) *Obsession* factor. *Money status* resembles Yamauchi and Templer's (1982) *Power-Prestige* dimension of money

attitudes. *Money vigilance* contains items that are very similar to those of the *Security/Conservative* subscale of the MBBS. *Money vigilance* also contains a number of statements that resemble the rather neurotic state of being unwilling to spend money indicated by the *Distrust* dimension of the MAS and the *Retention* dimension of the MBSS. Furthermore, same as in studies using the older measures, no strong connection between a person's income and money-related attitudes could be established.

4.2.3 Discussion

In this section four psychometric measures for money attitudes have been reviewed. As compared to the money-related typologies presented in section 4.1, the money attitude framework has some clear advantages. Instead of classifying people into categories on an all-or-nothing basis, money attitude scales measure intensities of different money-related habits and beliefs. Researchers can employ these money attitude inventories to gain more insights into the question as to how widespread certain money attitudes are among common people. They also allow for a finer graduation between people who obviously suffer from a money-related pathology (e.g. misers), those who show no abnormalities when dealing with and thinking of money and those who are located somewhere in between the pathological and the healthy case. In contrast to the self-diagnose questionnaires published by the authors of money-related personality typologies, the money attitude inventories reviewed here had been carefully tested and validated before being published. Established measures like the MAS or the MBBS have satisfactory psychometric properties and continue to produce reliable results.

What should be kept in mind is that the psychological concept of money attitudes in general and the existing psychometric scales in particular are statistical constructs. Although money-related personality theories and typologies have had a considerable impact on the research dealing with common people's monetary behaviour and perception with respect to money, the dimensions or facets of what has become commonly known as 'money attitudes' have been derived from factor analysis of survey data. Although the labels of several money attitude sub-constructs like 'power', 'retention' or 'obsession' bring to mind the money-types described by personality theorists, these sub-constructs do not always refer to particular money pathologies. Still, there are some similarities between these statistical constructs and the personalities described in the psychoanalytical literature on money. For example, all four inventories reviewed above encompass at least one dimension which refers to money as a symbol of power. Also, careful budgeting and neurotic money retention, i.e. behavioural components of money attitudes which clinicians often explain by the security meaning of money, is accounted for by most money attitude measures. By contrast, neither viewing money as a symbol for freedom nor the opposite attitude internalised by so-called freedom fighters, play a role in the established money attitude inventories. Also, exaggeration of the need for love by compulsively spending money on oneself or on others has hardly turned out as a separate money attitude facet; it is usually part of the power-dimension of a money attitude inventory.

Furthermore, many different psychometric money attitude inventories have been published over the last decades. Instead of developing the existing measures further and refining them, even the famous representatives of contemporary money attitude research like Thomas Li Ping Tang have continuously proposed new money attitude scales. The list of money attitude measures presented in this section could be extended by at least ten more inventories which circulate in the psychological literature of money. Hence, the question arises which inventory a researcher who is interested in the topic of money attitudes should choose for his or her survey study. Furnham and Argyle (2000) recommend that researchers should base their choice on the following three criteria: (1) the psychometric properties of the measure, especially its reliability and validity; (2) the precise money attitude facet to be measured; and (3) practical questions such as the length of the questionnaire (see Furnham and Argyle, 2000: 53). In terms of reliability and validity the two older measures, the MAS and MBBS, appear to be preferable to other inventories because the reliability and validity of these measures has been confirmed in many empirical studies. The second criterion is typically of most concern for a researcher interested in measuring a particular facet of money attitudes. However, in the case of several inventories it is difficult to capture what precisely is measured by the many subscales. The labels of the subscales are little help and often even confusing. For example, both the MAS and MBBS encompass subscales labelled ‘power’ and ‘retention’, but the corresponding items describe very different money-related habits and beliefs. Regarding the third criteria, money attitude inventories generally consist of a considerable number of statements. Most existing inventories encompass 30 items or more. As a consequence, employing the entire inventory is time-intensive and might not be feasible in several cases. For example, the employment of all 60 items of the MBBS certainly poses problems in intercept surveys where respondents typically dispose of little time. A pragmatic solution to this issue consists of employing only the subscale which refers to the attitude facet a researcher is interested in. However, polling mostly similar items to measure one single attitude facet instead of covering more diverse money-related topics in a survey may bore the respondents and cause them to answer monotonically (e.g. by always choosing the same interval of the Likert scale).

Finally, like clinicians, the authors of the money attitude scales tend to use the word ‘money’ in an ambiguous way, at least from the economic perspective. To be more precise, many of the statements these scientists employ to measure money attitudes would have to be reformulated. For example, the statement ‘Most of my friends have more money than I do’ (Furnham, 1984) is not very meaningful from the economic perspective. Strictly speaking, this item states that a person’s friends have more notes and coins in their wallets, a fuller piggy bank or more savings. However, the idea that this item is ought to capture is, most probably, that a respondent thinks that his or her friends have higher incomes and are more affluent. To conclude, social psychologists took great effort to systematically measure people’s attitudes towards money. At the same time, the large variety of money attitude facets they identified and the considerable number of different inventories to measure the overall construct of money attitudes creates the impression

that the research on money attitudes lacks precision and a golden thread. There seems to be no agreement on the number of facets of money attitudes and the way in which these facets should be interpreted (see Furnham and Argyle, 2000: 60). However, the research on money attitudes shows that certain attitudes which Freud and his associates had described long time ago can be reliably measured and that these attitudes are of relevance not only among the clients of psychotherapists but also in the general population.

Summary of chapter 4

This chapter introduced selected psychological literature on money. In this literature money is, in contrast to the economic tradition, not merely analysed as a neutral means of payment but also as a symbol for power, security, love and freedom. Researchers with psychoanalytical background and social psychologists have extensively explored how people perceive money and how they deal with their financial resources. The literature on money pathology reveals some interesting money-related patterns which call into question the presumably neutral role of money for people's spending and saving decisions. For example, the stereotype of the miser described by several personality researchers or the survey respondent who agrees with seemingly irrational statements such as 'Even when I have sufficient money I often feel guilty about spending money (…)' (Furnham, 1984) challenge the neutrality postulate which is paramount in economic literature.

However, the psychological framework on money has its limitations. Most strikingly, psychoanalytical research is case-study based and provides no information regarding the relevance of money pathologies in the general population. The survey-based literature on money is more precise in accurately measuring and analysing common people's attitudes towards money-related issues. Many different validated money attitude scales have been proposed and research on money attitudes has become increasingly popular during the last decades. Although money attitude dimensions resemble the money pathologies that psychoanalysts described, money attitudes are a very different concept. Money attitude facets are statistical constructs; the associated psychometric scales encompass different kinds of components and mix together both behavioural and affective money-related statements; some of these statements reflect pathological habits; others appear very common and reasonable. While the psychological framework on money pathologies is quite clear cut, money attitudes are difficult to grasp. The meaning of the psychological variables measured by the multiple money attitude scales discussed in literature remains somewhat nebulous.

A more general observation is that some terms that are strictly defined and separated in economics, for example wealth, income and money, are regularly mashed up in psychological literature. Many scientists with psychological background adopt everyday speech when writing on money pathology or money attitudes. A reader frequently encounters sentences in psychological papers that are inaccurate from the economic perspective. 'Making lots of money' instead of

‘earning a high income’ is only one of many examples. Inevitably, this partly imprecise terminology had to be employed also in the present chapter and I will occasionally use the word ‘money’ to refer to wealth and income also in the following chapters.

The psychological literature on money reviewed in this chapter partly challenges the economic concept of money. In the next chapter the economic approach and the psychological approach to analyse money shall be further compared. Most importantly, the chapter addresses the question as to how money attitudes challenge the validity of environmental values assessed in contingent valuation surveys.

5 Money attitudes and environmental valuation

5.1 Economics vs. psychology: Reconcilable or contradictory concepts of money?

As explained in chapter 2, monetary values for environmental goods are typically assessed based on observations of consumption choices individuals make on markets which are somehow related to the environmental good in question (revealed preference techniques) or on contingent markets (stated preference techniques). Just as in the case of market goods, the amount of money a person is willing to give up in exchange for a particular environmental good is interpreted as the value he or she attaches to it. Thus, the decision of spending money – actually spending it or pretending that one would spend it – is a key element in any environmental valuation study. As argued by several psychotherapists, personality researchers, social psychologists and also by some behavioural economists, people's decisions to spend money are likely to be influenced not only by their preferences for different commodities and their budget constraints but also by their money attitudes (cf. chapter 3.3 and chapter 4). Several researchers with psychological background stressed that the absence of money attitudes in standard economics is due to economists' ignorance of the so-called symbolic dimensions of money (see e.g. Furnham and Argyle, 2000, Lea et al., 1987, Lane, 1993). However, as will be shown in the following section, this claim is not fully justified.

5.1.1 Money symbolism in economic literature

The psychological literature on money suggests that the way in which people think of money and how they acquire and use it is highly impacted by the symbolism inherent to money. Money does not exclusively represent the goods and services it can buy but also symbolises psychological needs like security, power and freedom, according to the psychological point of view. It is to be noticed that buzzwords like freedom, security and power can also be found in economic literature. However, unlike in psychological literature, these concepts are mostly associated with a person's level of wealth or income and not with money in the strict sense. This difference reflects the definition of money as a medium of exchange in standard neoclassical theory. In a narrow sense, an economic agent's money is the amount of coins and notes held in his or her wallet and the balance of his or her checking account. An economic agent's wealth is, of course, measureable in terms of money but encompasses more assets than just the most liquid ones. As already mentioned, the term money is used in a broader way in other behavioural sciences, including psychology. As highlighted in the previous chapter, the main representatives of psychological research on money like Goldberg and Lewis (1978) or Furnham (2014) often employ the term 'money' when referring to a person's wealth in general, regardless of whether this wealth is held in liquid forms (cash and bank deposits) or in other forms (e.g. shares, bonds, insurance, property, etc.). Keeping these conceptual differences in mind, there are still some similarities

between the symbolic meaning of money discussed in psychological literature and the economic concepts of freedom, security and power.

Freedom, for example, is a fundamental value in democratic societies and one of the central objectives of market economies (cf. e.g. Berg et al., 2007). Freedom can be interpreted as individuals' possibility of independently deciding on their economic lives. In this sense, freedom is immediately associated with wealth and money. In a market economy, individuals have, as explained for example by Simmel ([1907] 1982) a century ago, the possibility to sell their produced goods and services to anybody and to use the money they obtain in exchange for their sales for the purchase of commodities offered by completely different persons. This would not be the case in a barter economy, where exchange can only take place when the wants of two individuals coincide (cf. section 3.1.1). Freedom, as a fundamental objective in market economies, implies that people should have the possibility to earn income and to decide freely on the different possible uses of their income, i.e. spending, saving and investing. **Security** brings to mind some theories of monetary demand developed in the twentieth century. Pigou (1917), for instance, highlighted that 'everybody is anxious to hold enough of his resources in the form of titles to legal tender [i.e. money] both to enable him to effect the ordinary transactions of life without trouble, and to *secure* him against unexpected demands, due to a sudden need, or to a rise in the price of something that he cannot easily dispense with. For these two objects, the provision of convenience and the provision of *security*, people in general […] elect to hold [part of their wealth] in the form of titles to legal tender' (Pigou, 1917: 41, emphasis added). The security or precautionary motive for holding money is, of course, also recognised and considered as one of the central determinants for an individual's demand for money in contemporary macroeconomics. Furthermore, even the association between money and **power** sometimes appears in economic literature. As pointed out by Keynes ([1936] 2009), the enjoyment 'of a sense of independence and the *power* to do things, though without a clear idea or definite intention of specific action' (Keynes, [1936] 2009: 108, emphasis added) is one of the subjective reasons why consumers wish to save part of their income. Finally, Bernholz (2014) recently stressed the social consequences of the characteristics and people's perceptions of money. 'As a consequence of the fact that money can buy almost everything, rich people are considered to be very *powerful*. 'They have much money,' because their wealth is calculated in terms of money' (Bernholz, 2014: 56, emphasis added).

Thus, it would be wrong to argue that the 'symbolic meaning' of money (and wealth) has been completely overlooked by economists. Emotional association of money with freedom, security and power arise from the economic functions which money fulfils in market economies. At first glance, the psychological definition of money as a medium of exchange with symbolic meanings does not seem to contradict or challenge the economic concept of money. However, as pointed out by several clinicians and social psychologists, some people, often unconsciously, deal with money in a way which would not be predicted by economic models of rational choice in which money plays no role at all for individual behaviour (cf. chapter 4).

5.1.2 Money attitudes and consumer theory

Section 4.1 explored the psychoanalytical approach to explain pathological uses of money as an outcome of an irrational need for security, power, love and freedom. It has also been noted that the behaviour of certain money-types appears to be incompatible with the economic concept of money. Unfortunately, the reviewed theories and typologies are purely descriptive which makes it difficult to systematically analyse these different concepts. In order to get a deeper understanding of the different money-types, to verify to what extent they are represented in the general population and to check whether their money attitudes indeed represent an irrational view and use of money, these money-types would have to be identified empirically. This could be done, for example, by means of population surveys which encompass a suitable psychometric measure. While personality theorists like Goldberg and Lewis (1978) have described and analysed dozens of money-related pathologies without providing validated psychometric measures, social psychologists have developed the related and more measurable concept of money attitudes (cf. section 4.2). Money attitudes are multidimensional, meaning that they involve different attitude components. Although no consensus has been reached regarding the most relevant dimensions of money attitudes, there are three facets that appear in almost all of the existing money attitude inventories. Established money attitude inventories (e.g. Yamauchi and Templer, 1982, Furnham, 1984) as well as recently developed measures (e.g. Klontz et al., 2011) all encompass a facet which is related to people's association of money and power. The two other facets, which virtually always appear in money attitude research, are both related to the security meaning of money; one of them describes a forward looking person who carefully budgets for present and future consumption; the second facet refers to a more pathological view and use of money which has been described as miserliness or compulsive saving in clinical literature. In the following, these three money attitude dimensions shall be analysed with respect to their potential impact on the results of environmental valuation studies. A money attitude facet is likely to have an effect on a person's WTP for environmental goods if this facet is systematically related to a person's overall spending behaviour. Furthermore, the question whether the three money attitude facets considered here might translate into behavioural patterns that are at odds with economic theory shall be explored.

When using money attitude inventories in surveys, respondents are typically asked to express their agreement with these attitude statements on Likert scales; the higher the agreement with the individual statements is, the higher is the overall score on the subscale will be. The following paragraphs are dedicated to the interpretation of high scores on several money attitude subscales which refer to three commonly mentioned components (power, budgeting and miserliness). For each of the three common facets, it will be examined whether high scores on the corresponding scale reveal that the attitude in question may systematically affect a person's consumption decisions and whether a high score points to some form of monetary behaviour which contradicts the economic motives for spending or retaining one's financial resources. The analysis is limited to the most frequently used money attitude inventories, which are Yamauchi and Templer's (1982)

Money Attitude Scale (MAS) and Furnham's (1984) Money Beliefs and Behaviour Scale (MBBS).

Money as a symbol for power: posers and money-obsessed people

The MAS and MBBS both encompass subscales which measure an attitude facet which resembles the financial habits and beliefs of power-obsessed people. The subscale most accurately resembling Goldberg and Lewis' (1978) description of people who associate money with power are the MAS power-subscale and the MBBS obsession-subscale. These two inventories are displayed in Table 5-1.

The items of both scales can be classified in three categories: the habit to bribe others (item 1 of the power-subscale; item 6 of the obsession-subscale); the habit of boasting about one's income, wealth and material possessions (item 2, 5 of the power-subscale; item 2 of the obsession-subscale) and the tendency to show more respect towards affluent people than towards the less well-off (item 4, 6, 7, 8 and 9 of the power-subscale and item 8 of the obsession-subscale). In addition to that, the obsession-subscale contains several items which point to an unusual importance attached to 'making money' and 'having money' (item 1, 3, 4, 5, 7). This latter set of statements closely resembles the kind of person which Forman (1984) named a 'tycoon' and which Goldberg and Lewis (1978) discussed as 'empire builders'.

Bribing others may be viewed as using money as a tool to purchase some particular services offered by other people. From this perspective, using 'money to influence other people to do things for me [oneself]' does not contradict the economic concept of money as a medium of exchange. Although the purchased 'things' like favours or approval do not belong to the kind commodities serving as examples in economic textbooks, money is simply used as a means to an end. Boasting about one's money and judging people by the amount of money they have or make is in accordance with the economic paradigm as well. One of the key economic functions of money is its role as a unit of account. A price expressed in terms of money indicates the value of a commodity, a particular wage or salary the value of a certain type of work. People who agree with the statements of the power- or the obsession-subscale seem to apply the same principle when judging themselves and other people. Of course, economic theory does not suggest that people *should* think in monetary units when assessing how successful, important, lovable or powerful their fellow citizens are. However, given that value is expressed in terms of money in so many aspects of life, it comes as little surprise that some people tend to apply this concept to interpersonal relationships.

Table 5-1: Subscales for power-obsessed money-types

Power-subscale (Yamauchi and Templer, 1982)	Obsession-subscale (Furnham, 1984, Wilhelm et al., 1993)[1]
7-point Likert scale 'never' (1) to 'always' (7)	7-point Likert scale 'disagree' (1) to 'agree' (7)
(1) I use money to influence other people to do things for me.	(1) I feel that money is the only thing that I can really count on.
(2) I must admit that I purchase things because I know they will impress others.	(2) I am proud of my financial victories - pay, riches, investments, etc. - and let my friends know about them.
(3) In all honesty, I own nice things in order to impress others.	(3) I would do practically anything legal for money if it were enough.
(4) I behave as if money were the ultimate symbol of success.	(4) I firmly believe that money can solve all my problems.
(5) I must admit that I sometimes boast about how much money I make.	(5) Compared to most people I know, I believe that I think about money much more than they do.
(6) People I know tell me that I place too much emphasis on the amount of money a person has as a sign of his success.	(6) I often use money as a weapon to control or intimidate those who frustrate me.
(7) I seem to find that I show more respect to people with money than I have.	(7) I believe that time spent not making money is time wasted.
(8) Although I should judge the success of people by their deeds, I am more influenced by the amount of money they have.	(8) I sometimes feel superior to those who have less money than I regardless of their ability and achievement.
(9) I often try to find out if other people make more money than I do.	

[1] In the initial study three additional items loaded on the obsession factor and were included into the scale. The list presented here is limited to those items which were confirmed in a follow-up study by Wilhelm et al. (1993).

The question whether the obsession with making and having money (or, more correctly: earning high incomes and being wealthy) systematically affects people's spending decisions cannot be answered straightforwardly. Unfortunately, the statements of the power-subscale and the obsession-subscale do not contain any information concerning the purpose, such as consumption, investment or simply the accumulation of funds, for which money is desired. Since only a few items of the two subscales refer to behavioural components of money attitudes it is also impossible to assess whether or not the spending and saving habits of a person who attributes extraordinary importance to wealth and a high income systematically differ from other people's financial behaviour. However, when looking at the structure of the overall money attitude inventory rather than merely interpreting the items of the subscale, at least some conclusions regarding the spending and saving behaviour of people who score high on the power- or obsession-facet can be drawn. Being the result of the factor analysis of dozens of money-related statements, neither the

power- nor the obsession-subscale shows any significant correlation with other dimensions of the MAS and MBBS inventory, including budgeting or stinginess. Thus, people who view money as a symbol of power are most likely neither particularly thrifty nor stingy. However, there is some empirical evidence that wasteful behaviour systematically relates to the power-dimension of money attitudes. Hanley and Wilhelm (1992) and Khare (2014), for example, found that compulsive buying was positively related to the power-facet of money attitudes. Hence, it can be speculated that the power-variable is positively correlated with expenditure levels.

Security-orientated money-types: budgeting and planning

Psychoanalysts and other personality researchers have highlighted that people differ in terms of thriftiness (cf. chapter 4). While many individuals place much importance on present consumption and mostly deplete their monthly income, others are more concerned about their living standard in future periods of life and regularly put part of their current income aside. Having some money saved for emergencies and retirement gives them a feeling of security. It is to be noted that the attitude dimension considered here is not to be equalled with the beliefs and behaviour of a pathological miser. The variable in question refers to different levels of importance attached to budgeting and financial planning, or in economic jargon, different rates of time preference. Attitudes towards thrift and saving are an element of all money attitude inventories, including the MAS and MBBS. The corresponding subscales are displayed in Table 5-2.

In Yamauchi and Templer's (1982) initial study on money attitudes, seven items referring to an individual's attitudes towards financial planning and saving loaded on a factor which the authors labelled *Time-Retention*. All statements included in corresponding subscale describe the behaviour of people who wish to prepare financially for the future. Individuals scoring high on this dimension 'could be described as placing great value on the process of preparation as well as the goal of security in the future' (Yamauchi and Templer, 1982: 523). Furnham (1984) identified a similar factor which he named *Security*. The security-subscale covers, in addition to several items reflecting great concern for financial planning (item 1, 2, 3 and 6), a statement revealing a person's dislike of talking about money-related issues (item 4) as well as an item referring to an individual's parents' money attitudes (item 5). While the simultaneous occurrence of great concern for financial security and the consideration of money-related questions as a taboo topic has been frequently observed and described by psychotherapists (cf. e.g. Trachtman, 1999), the fifth item appears to be more difficult to reconcile with the overall theme of the security-factor. It can be speculated that attitudes towards thrift are more likely to be learnt and imitated from one's parents than other money-related attitudes.

Dealing carefully with one's financial resources and saving money for later periods of life is perfectly in line with intertemporal theory of consumer choice. If a person's attitudes towards thrift and saving translate into actual market behaviour, it can be expected that people who score high on the time-retention- or the security-subscale spend less and save more money in comparison to people with a low score, given their income levels and preferences for goods and services. Thus, there might be an effect of this particular money attitude facet on overall spending.

However, there is no reason to believe that attitudes towards thrift and saving systematically distort a person's spending decisions. Refraining from spending money on present consumption neither represents an ill-founded perception nor an uncommon use of money but most likely reflects the importance an individual attaches to future consumption.

Table 5-2: Subscales for security-oriented money-types (foresight)

Time-retention-subscale (Yamauchi and Templer, 1982)	Security-subscale (Furnham, 1984)[1]
7-point Likert scale 'never' (1) to 'always' (7)	7-point Likert scale 'disagree' (1) to 'agree' (7)
(1) I do financial planning for the future. (2) I put money aside on a regular basis for the future. (3) I save now to prepare for my old age. (4) I keep track of my money. (5) I follow a careful financial budget. (6) I am very prudent with money. (7) I have money available in the event of another economic depression.	(1) I always know how much I have in my savings account. (2) I am proud of my ability to save money. (3) I know almost to the penny how much money I have in my purse, wallet or pocket at all times. (4) I believe that it is rude to enquire about a person's wage/salary. (5) My attitude towards money is very similar to that of my parents. (6) I prefer to save money because I'm never sure when things will collapse and I'll need the cash.

[1] Items which had a factor loading of ≤0.400 in the initial study are not displayed.

Security-oriented money-types: miserliness

In addition to the statements referring to a rational and common concern for future financial security, MAS and MBBS encompass items that were originally formulated by Goldberg and Lewis (1978) in an attempt to describe people who strive for emotional security by accumulating their financial resources (so-called 'security collectors' which encompass the sub-group of stingy 'compulsive savers', cf. section 4.1.2). These items are elements of the MAS distrust-subscale and of the MBBS retention-subscale (cf. Table 5-3).

The items of the distrust-subscale can be classified into two categories, namely items describing a consumer who is mistrustful towards salespersons (item 1,2, 3, 5 and 7) and items referring to a person's unwillingness to spend money in principle (item 4 and 6). Making up a single money attitude facet these items must be highly correlated. In other words, people who are mistrustful towards salesmen are often at the same time tight with their money. This relationship is in line with the psychoanalytical literature on money retention and miserliness. Goldberg and Lewis (1978) and Forman (1987) described people who hate spending and tend to hoard their money as

extremely distrustful. The overall factor can thus be interpreted as a person's tendency to feel a sense of conflict over spending money. The authors of the distrust-subscale proposed the following interpretation: A high score on the distrust-subscale indicates that a person has 'hesitant, suspicious, and doubtful attitudes' (Yamauchi and Templer, 1982: 524).

Table 5-3: Subscales for security-oriented money-types (miserliness)

Distrust-subscale (Yamauchi and Templer, 1982)	Retention-subscale (Furnham, 1984)[1]
7-point Likert scale 'never' (1) to 'always' (7)	7-point Likert scale 'disagree' (1) to 'agree' (7)
(1) I argue or complain about the cost of things I buy.	(1) I often say 'I can't afford it' whether I can or not.
(2) It bothers me when I discover I could have gotten something for less elsewhere.	(2) Even when I have sufficient money I often feel guilty about spending money on necessities like clothes etc.
(3) After buying something, I wonder if I could have gotten the same for less elsewhere.	(3) I often have difficulty in making decisions about spending money regardless of the amount.
(4) I automatically say, 'I can't afford it,' whether I can or not.	(4) I prefer to save money because I'm never sure when things will collapse and I'll need the cash.
(5) When I buy something, I complain about the price I paid.	(5) I often buy things that I don't need or want because they are in a sale or reduced in a sale or reduced in price.
(6) I hesitate to spend money, even on necessities.	
(7) When I make a major purchase, I have the suspicion that I have been taken advantage of	

[1] In the initial study a an additional item was reported: 'I often feel inferior to others who have more money than myself, even when I know that they have done nothing of worth to get it'. This item loaded ambiguously on both the obsession-factor and the retention-factor and was therefore excluded from the scale in most subsequent studies that made use of the retention-subscale.

Regarding the retention-subscale all but the last item fit the description of a miser. Three items refer to a general unwillingness to spend money (item 1, 2, 3) and one item describes a paramount fear of financial loss (item 4). The wording of the fifth item ('I often buy things that I don't need (…)'), stems from Goldberg and Lewis' (1978) description of the compulsive bargain hunter. Again, the correlation of items referring to one stereotype within the category of security-oriented people with an item describing another money-type within the same category is in line with several personality theorists' observations. Goldberg and Lewis (1978) highlighted that compulsive saving and bargain hunting were two forms of behaviour that are not mutually exclusive. Furthermore, Furnham (1996) came to a similar conclusion when validating Forman's (1987) money sanity scale. This validation study showed that miserliness and bargain hunting could hardly be isolated in a factor analysis, meaning that people's answers to the miser-items

were highly correlated to their answers to the items referring to bargain hunting (cf. section 4.1.3). Taking the retention subscale as a whole, high scores can be interpreted in a similar way as high scores on the distrust scale, namely as a person's tendency to feel a sense of conflict over spending money. However, the retention-subscale contains more items than the distrust-subscales that reflect some form of neurotic behaviour. Given the similarity of several statements with the habits of pathological misers, Furnham's (1984: 504) interpretation of high scores on the retention-subscales as 'the attitudes of the people who are very careful with money' sounds too weak to be accurate. Rather than being careful consumers, people scoring high on this scale are likely to have the pathological tendency to accumulate their financial resources. In line with this impression, the authors of later studies interpreted the retention-variable in that way (c.f. e.g. Lea et al., 1987, Lane, 1993, Lim and Teo, 1997, Wiepking and Breeze, 2012).

Economic theory postulates that the possession of money as such is useless. Its value is determined solely by the things it can buy. Hence, retaining one's money is unreasonable unless an individual plans to spend it in the future. The behaviour of a miser who finds 'happiness in owning money without ever getting round to the acquisition and enjoyment of particular objects' (Simmel, [1907] 1982: 327) is typically classified as irrational in economic literature (cf. e.g. Niehans, 1978: 14). Agreement with a statement like 'Even when I have sufficient money I often feel guilty about spending money on necessities like clothes etc.' or 'I often say 'I can't afford it' whether I can or not' may indicate that a person belongs to the group of irrational misers who enjoy accumulating money and hate spending. At the same time, a person who agrees with the statements of the distrust scale, especially items 1, 2 and 3, might be just a price-conscious consumer who aims to get the best out of his or her budget. Furthermore, a person who wishes to be secured against emergencies and saves a considerable part of his or her income may also reach a high score on most attitude statements of the distrust and the retention scale. In contrast to miserliness, price-consciousness and precautionary saving are compatible with the economic concept of the rational consumer, who maximises (life-time) utility through consumption and aims to minimise expenditures. Hence, in order to answer the question of whether the attitudes of this second category of security-oriented money-types challenges the economic concept of the rational consumer, one needs to know what kind of attitude the distrust and the retention scale actually measure. Goldberg and Lewis (1978) stressed that the behaviour of people with an extraordinary need for financial security differs from what an economist would call saving. According to the authors, compulsive savers do not save for consumption during retirement or emergencies; they are driven by a compulsion to retain their money (ibid: 104). When observing the structure of several money attitude inventories, this affirmation seems to be confirmed. Yamauchi and Templer (1982) and Furnham (1984) both found separate sub-constructs reflecting a desire for future financial security (the time-retention dimension of the MAS and the security dimension of the MBBS which have been already analysed) in addition to the money attitude facet referring to a person's unwillingness to spend money on anything. Thus, the money hoarding sub-construct may indeed describe a phenomena that is different from a person's concern for

future financial security. If money retention is neither motivated by a lack of financial resources nor by the concern for future consumption, high scores on the distrust or the retention-subscale are likely to be an outcome of miserliness.

An apparent illogicality is that both subscales involve statements referring to both stinginess and acquisition. The question arises why these two behavioural patterns, that are at first glance opposites, represent one single psychological variable. A rather obvious explanation of this issue is that even extremely stingy people need to spend some money on basic consumption such as food, clothes and housing. It seems plausible that in the exceptional case of spending money a miser complains about the price paid, tries to bargain and gets angry when he or she discovers that there would have been better deals. The second explanation has been already mentioned and is based on the money-related personality typologies in which miserliness appears. Goldberg and Lewis (1978) described three types of personalities that share a common ground, namely being very tight with money in most but not in any situation: the compulsive saver, the self-denier and the bargain hunter (cf. section 4.1.2). It is expected that all three types of persons would agree with statements like 'I often say 'I can't afford it' whether I can or not' although they are motivated by different desires. The compulsive saver strives for money for the sake of accumulating it, the self-denier enjoys self-imposed poverty and the bargain hunter acts stingy in the hope of getting a desired good for a lower than the announced price. Furthermore, a statement such as 'I often buy things that I don't need or want because they are in a sale or reduced in price' can be speculated to be denied by compulsive savers and self-deniers but accepted by bargain hunters. Consequently, if there are a considerable number of bargain hunters within the surveyed population, items pointing to stinginess and items referring to acquisition are necessarily positively correlated.

To sum it up, the distrust and retention scale contain items reflecting the attitudes of misers, which are typically classified as irrational individuals in economic literature. Unlike the other money attitude facets explored in this section, it appears likely that miserliness systematically affects a person's spending behaviour. Compared to other consumers, individuals who reach high scores on the corresponding money attitude subscale are expected to generally spend a lower proportion of their income and more often refrain from spending money at all. Based on the case studies published by several psychotherapists, it seems very probable that money retention distorts an individual's consumption decisions. Due to their ill-founded compulsion to accumulate money and the psychological pain they experience when spending money, misers may underestimate the benefit accruing from the consumption of goods and services they could purchase with their financial resources.

Considering the different facets of money attitudes which have been explored in the present section, only one facet has been identified as unambiguously affecting and potentially distorting a person's spending behaviour. The facet which poses a problem refers to behaviour of the stereotype of a miser who fiercely retains his or her money. In contrast, neither the power-dimension

nor the budgeting and planning facets of the two most commonly used money attitude inventories obviously challenge the economic concept of the rational consumer who values money exclusively for the things it can buy. Only extreme miserliness is likely to systematically influence a person's consumption patterns and even distort spending decisions. Since spending decisions – either actual or hypothetical – are key elements of an environmental valuation study, the phenomena of miserliness merits more attention in this context. The goal of the next section consists of scrutinising the consequences of this particular money attitude for the definition of the welfare measures which build the theoretical basis of environmental valuation studies (cf. section 2.2.1).

5.2 Money retention and welfare measures

In this section two approaches of integrating attitudes towards spending money into the economic framework are presented. The first approach consists of introducing money into the neoclassical utility function. The second approach recurs to an alternative variant of preference orderings discussed in economic literature, namely lexicographic orderings. Both approaches yield similar conclusions regarding the amount of money a miser would be willing to give up in exchange for an environmental improvement. However, these two approaches have different implications for the validity of the WTP figures assessed in survey-based environmental valuation studies.

5.2.1 Money as an argument in the utility function

For the stereotypical miser money becomes an object of consumption. The miser accumulates money for an undefined purpose and derives pleasure from amassing more and more cash. Money thus receives the character of a good and the pure possession of money alters the miser's utility. If money is desired for its own sake, an individual's preferences can be described by means of a direct utility function which is monotonically increasing in market consumption (x_h), the amount of money held (m_h) and the public good environmental quality (z), yielding to a utility function of three arguments $u_h(x_h, m_h, z)$. Like an ordinary consumer, a miser maximises his or her utility with respect to an exogenously given income I_h. While part of this income is spent on market goods, the remaining part is retained for psychological reasons, for instance because storing money in his or her piggy bank bolsters the miser's feeling of security. The constrained maximisation problem then becomes

$$\max.\ u(x_h, m_h, z) \text{ subject to } I_h = px_h + m_h;\ z = z^k;\ (h = 1,2, \dots, H), \tag{5-1}$$

where p is a vector of market prices including the price of money which is set to one and where income I_h equals the amount of money the individual spends on market consumption (px_h) plus the amount of money held (m_h). In line with the standard expression that was introduced in section 2.2.1, the utility change accruing from an isolated change in environmental quality can be expressed as

$$\Delta U_h^{01} = v_h(p, z^1, I_h) - v_h(p, z^0, I_h) \; ; (h = 1,2, \dots, H) \tag{5-2}$$

In the case of an environmental improvement, an individual's utility increases, irrespectively whether the individual is tight or loose with his or her money. Accordingly, in the new situation even an extremely stingy person could give up some market consumption or part of his or her money holdings without being worse off than in the initial situation. This reflects the implicit assumption that also a miser is generally willing to trade environmental quality against money. Same as in the standard case, where money is not treated as an argument of the utility function, the Hicksian Compensation Variation corresponds to the income variation that would exactly compensate an environmental improvement in terms of utility. Similar to the usual interpretation, the CV can be approximated by a person's maximum willingness to pay for the environmental improvement, i.e. the maximum decrease in his or her money holdings and/or market consumption that he or she would tolerate to maintain the same level of utility as in the status quo:

$$v_h(p, z^1, I_h - WTP) = v_h(p, z^0, I_h) \; ; (h = 1,2, \dots, H) \tag{5-3}$$

Hence, inserting money as an additional argument into the utility function hardly changes anything. Individual welfare measures like the CV can be defined; however, their interpretation is slightly different as compared to the standard case. Rather than understanding the CV merely in terms of market consumption an individual could give up in exchange for the environmental improvement, it has now to be interpreted in terms of forgone market consumption or as the sum of money that could be deducted from an individual's cash holdings or as a combination of both. For this reason, not only an individual's preferences for market consumption and environmental quality but also his or her attitudes towards spending money will matter for the amount of income he or she is willing to give up to obtain an environmental improvement. It is expected that, ceteris paribus, the higher a person's psychological need to accumulate money is, the lower his or her WTP will be. It is important to note that an individual's WTP can still be interpreted as a valid welfare measure for the utility accruing from improved environmental quality in the case considered here. So far, from a theoretical point of view, preferences for accumulating money for some undetermined purpose do not seem to pose a problem for environmental valuation studies.

5.2.2 Lexicographic decision rules

Another possibility for describing the behaviour of a miser consists of employing the concept of lexicographic preferences. Lexicographical preference orderings are usually disregarded in standard consumer theory because economists consider them as a rare exception. The textbook examples for lexicographic preference orderings are people who are addicted to the consumption of a particular good, for example junkies or alcoholics. Since such extreme consumption patterns are uncommon, they are of little concern for the prediction of ordinary consumption decisions. In the present study, however, the spending decisions of people who suffer a particular compulsion, namely a pathological tendency to accumulate money, are of particular concern. Naturally, it cannot be assumed that misers never spend money. According to the psychoanalytical literature

on money retention, these people do spend some money on necessities such as housing and food. However, lexicographic preferences appear to be a suitable concept for describing and predicting the behaviour of stingy people when it comes to spending money on less essential things, like environmental goods. One may think of misers as people who group, as postulated by Thaler (1985, 1999), their budget into different 'mental accounts'. Misers have at least two such accounts, namely an account for crucial expenditures (e.g. food, clothes, housing) and an account, where they hoard their remaining funds (e.g. a savings account or a piggy bank). While misers occasionally spend money out of the former account they will never touch their hoarding account voluntarily. Accordingly, the standard model of consumer choice, which is based on the concept of neoclassical preferences, applies to situations involving crucial expenditures. Lexicographic decision rules, as described in the following paragraphs, apply to a miser's hoarding account.

Following the traditional meaning of the concept, individuals with lexicographic preference orderings make binary choices among alternative bundles of goods based on a particular rule. Formally, this rule is a linear order which indicates the relative importance an individual attributes to the different goods contained in the bundles at choices. Choices among two alternative bundles of goods are always dominated by an individual's preference for the good which comes first in this linear order. In contrast to a standard neoclassical preference ordering, an individual does not consider all goods contained in alternative bundles when making a choice; in the lexicographic case, an individual considers one particular good as absolutely important. Only if both bundles contain the same quantities of the primarily important good, the second most important good is relevant for the choice. If both alternatives do neither differ in the first nor the second most important good, the third most important good matters and so on. A particular feature of lexicographic preferences is that individuals are never indifferent when having the choice of two alternatives. In other words, there are no two bundles of goods which yield the same level of utility when consumed, unless these two bundles contain exactly the same kinds and quantities of goods. As can be inferred from the name of this concept, lexicographic orderings resemble the arrangement of words in a lexicon; based on the alphabetical rule, no two words which are spelled differently can occupy the same rank in a dictionary (c.f. Edwards, 1986).

Same as standard neoclassical preferences, lexicographic preferences satisfy the three rationality axioms (completeness, transitivity and reflexivity) and the axiom of non-satiation. However, neither the continuity nor the convexity axioms apply in the case of lexicographic preferences (c.f. Lockwood, 1996). As a consequence, there are no indifference relationships for this kind of preference structure and, as shown by Debreu (1954), no continuous utility function exists. For this reason, welfare measures, which presuppose the existence of a continuous utility function, cannot be defined. Hence, the WTP for an environmental good of a person with lexicographic preferences cannot be interpreted in terms of the Hicksian Compensating Variation (c.f. Edwards, 1986).

The economic concept of lexicographic orderings can be transferred to the psychological concept of miserliness. Like addicts, stereotypical misers act according to a particular decision rule

which says that more money is always preferred to less, irrespectively what happens to other aspects of life, like their health, other people's wellbeing, the state of the environment, etc. Money ranks first in the linear order of goods; its accumulation is immeasurably more important than the consumption of any other good. When choosing among alternatives which imply changes of different magnitude in a person's cash balance, the miser will always opt for the alternative which implies the highest money balance, regardless of all remaining attributes in which these alternatives differ. For example, when asked to make a choice between donating a certain amount of money for a good cause and keeping the money, the miser will always prefer the latter option, regardless of the purpose of the donation. Formally, binary choices involving an environmental good z provided at different levels and different amounts of money m can be defined in terms of lexicographic preferences such as

$$(m^1, z^1) \text{ is preferred to } (m^0, z^0) \text{ iff}$$

$$m^1 > m^0 \text{ or}$$

$$m^1 = m^0 \text{ and } z^1 > z^0,$$

The choice between two alternatives (m^k, z^k) is primarily determined by the quantity of money m and only secondarily by the quantity and quality of the environmental good z. Thus, whenever the two alternatives differ in terms of money, the alternative which implies more money is preferred (cf. second line of the formal expression). Only in the case that both alternatives do not differ in terms of money, the quantity or quality of the secondarily important good, environmental quality in the case considered here, is decisive (cf. third line of formal expression). As highlighted by Fishburn (1974: 1446), small but perceptible differences in the quantity or quality of a good may be disregarded in practise. Thus, if two alternatives differ only slightly in terms of money, for example by a few cents but imply significantly different levels of environmental quality, even a miser may make his or her choice on the basis of the environmental good. However, as soon as the loss of money becomes palpable, the environmental good does not affect the miser's choice at all.

What follows from the simple model introduced here is that a miser who employs a lexicographic decision rule which assigns absolute priority to money completely ignores the environmental good when choosing among alternatives which significantly differ in terms of the loss of money they imply. As soon as an alternative would lead to a significant reduction of his or her money holdings, the miser refrains from choosing it and opts for the alternative which leaves his or her money balance unaffected. It can be inferred that a miser who is confronted by the typical kind of choice presented in an environmental valuation study, namely keeping his or her money and forgoing an environmental improvement or giving up some amount of money to obtain an environmental improvement (i.e. $m^1<m^0$ and $z^1>z^0$), will always opt for the status quo situation, regardless of what happens to the state of the environment. In the strict sense of the concept, a miser's choice is exclusively determined by the consideration of his or her money balance and completely unrelated to the kind, scale and scope of the environmental good in question.

In the case of stated preference surveys, the WTP statements of misers, who exclusively focus on the money attribute of an alternative but fully neglect its environmental attributes, are meaningless. The true WTP of a miser must be zero, or extremely low, irrespective of the environmental improvement in question. For example, assuming that stated WTP reflects true WTP, a miserly respondent will always tick zero on a payment card or consistently answer 'no' when being asked a referendum question during a CVM interview. Similarly, when participating in a choice experiment a miser will always select the cheapest option from a choice set and ignore all other attributes of the alternative policy options presented on each choice card. Things change when applying the weaker variant of lexicographic orderings and allowing for the disregard for small differences. Even a miser may tolerate to give up a very low amount of money to obtain the environmental good. For example, in a CVM survey, a miser may tick a very low amount on a payment card or answer 'yes' to a referendum question when assigned a very low bid. In contrast, a miser is expected to return to the strict lexicographic decision rule as soon as the amount of money to be paid becomes tangible. Obviously, WTP statements which are, aside from the exceptions just mentioned, completely unrelated to the environmental good in question cannot be considered as valid measures for the utility change accruing from an improved provision of that good. Furthermore, if the share of respondents that applies money-focused lexicographic decision rules is of statistical importance, average WTP and hence the estimated social benefit accruing from an environmental project might dramatically underestimate the actual social value of that project. As a consequence, the outcome of cost-benefit assessments would be misleading.

To conclude, irrespective of the way of describing the behaviour of misers theoretically, there is always a negative relationship between people's attitudes towards spending money and WTP. The money-in-the-utility function approach and the model of lexicographic preferences yield similar predictions about the amount of money that stingy people are willing to give up in exchange for an environmental improvement: this amount must be zero or extremely low. Hence, WTP can be expected to be a decreasing function of money retention.

However, the two approaches of integrating attitudes towards spending money into the economic framework have different implications for the validity of theoretical welfare measures. While treating money as an additional argument of the utility function has merely any effect regarding the definition and interpretation of the Hicksian compensating variation, lexicographic preferences challenge one of the key assumptions underlying the economic valuation of environmental changes, namely that individuals are willing to substitute environmental quality for money. Hence, the existence of misers in the general population may bias the results of survey-based environmental valuation studies. Yet, it might be the case that the share of misers in a society is so small that their presumably meaningless zero WTP statements do not matter at an aggregate level. Even if all interviewed misers have stated a zero WTP that is completely unrelated to the environmental good of concern, the sample's average WTP, and hence the social value of this good, will not be significantly affected in the case that only a few misers exist in the

surveyed population. Doubts regarding the meaningfulness and the interpretability of the survey results arise only if the share of misers within a population is of statistical relevance. Accordingly, before theorising on the impacts of money attitudes on the results of contingent valuation surveys, the question whether or not miserliness matters at an aggregate level needs to be addressed. In addition to that, it is not clear whether or not attitudes towards spending money, which are typically measured on self-report psychometric scales and therefore vulnerable to bias, have an observable impact on actual economic behaviour like buying, saving, investing, etc. If it turned out that self-reported money retention had no effect on real market behaviour, it would be rather implausible that this money attitude facet affects hypothetical spending decisions. Furthermore, it may be the case that attitudes towards spending money are merely a function of a number of other individual characteristics like income, education and age, so that the assessment of this attitudinal variable becomes redundant. In an attempt of getting more insight into these still open questions, empirical studies on money retention will be scrutinised next.

5.3 Money retention: empirical evidence

Psychoanalysts and other clinicians extensively wrote about some people's tendency to fiercely retain their financial resources (cf. section 4.1). Most psychometric measures for money attitudes encompass a list of items referring to a state of unwillingness to spend money, a phenomenon that is usually called 'retention' in psychoanalytical literature. Several of the corresponding items have been adapted from the description of misers that can be found in Goldberg and Lewis' (1978) and Forman's (1987) books on money pathology and in Freud's ([1908] 1976) article on money retention. A few economists, especially those involved in behavioural finance, have pointed to the relevance of money spending dispositions for the explanation of individual consumption behaviour (cf. section 3.3). Schmölders (1982), for example, showed that thrift and miserliness matter for people's spending and saving decisions. Furthermore, Prelec and Loewenstein's (1998) concept of the 'pain of paying' strongly resembles the kind of psychological burden towards spending money that has been comprehensively described in the psychological literature on money.

Although money retention is extensively discussed in the psychological literature, it is still an open question as to how widespread the phenomenon actually is in the general population. In economics the phenomenon is usually completely disregarded, especially when it comes to miserliness which is, if at all, merely mentioned as an example of irrational behaviour. Psychometricians have attempted to make money spending dispositions measurable and to analyse them empirically by means of money attitude scales. Analysts can use the attitude statements encompassed by these scales to identify misers in surveys. This section focuses on empirical research on money spending dispositions in general and miserliness in particular. A number of difficulties related to the measurement of people's money spending dispositions and the identification of misers shall be illustrated. Afterwards empirical studies that have linked money retention to so-

cio-demographic variables, personality traits and actual spending and saving behaviour will be reviewed.

5.3.1 Difficulties related to identifying misers in surveys

Like any other personality trait or attitude, miserliness can hardly be observed directly. To make individual characteristics measurable psychologists and social scientists employ self-report questionnaires that include statements referring to the attitude or personality trait to be measured. Based on an individual's agreement with one or several statements, a variable indicating the strength of an individual's attitude is generated. In statistical analysis this variable can then be linked to the personality, demographic and socio-economic status of a person and to actual behaviour (c.f. Hanley and Wilhelm, 1992). Some researchers attempted to identify misers with one or several dichotomous (yes/no) questions (e.g. Schmölders, 1982, Forman, 1987). However, the more widespread approach consists of employing a money attitude inventory which encompasses multiple items referring to hoarding behaviour, extreme stinginess and paramount fear of losing money. As explained in chapter 4 most money attitude inventories encompass items which describe the behavioural pattern of exaggeratedly retaining one's money instead of spending it. Out of the four inventories which have been reviewed in section 4.2.2 three encompass attitude statements referring to a person's feelings of conflict over spending money. The retention-subscale of the MBBS (Furnham, 1984), the distrust-subscale of the MAS (Yamauchi and Templer, 1982) and the more recent money attitude measure (Klontz et al., 2011) all include such items. However, none of these inventories offers a subscale that exclusively and unambiguously measures miserliness. Because of the partly similar habits of misers, compulsive bargain hunters, price-conscientious people and other types of consumers, not only misers are likely to score high on these scales. For this reason, researchers who want to identify people who fiercely retain their money should treat a high score on these scales with some caution.

Another difficulty related to identifying misers is the observation that self-report tightness with money does not always translate into non-spending. Goldberg and Lewis (1978), for example, highlighted that compulsive saving, bargain hunting and self-denying were not mutually exclusive. Hence, a person who fits the stereotype of a miser in most situations may occasionally spend considerable amounts of money on items sold at reduced price or on gifts. Tatzel (2002) therefore suggested that tightness with money should be combined with other variables of individual difference in order to predict spending decisions more accurately. She proposed an integrated model of consumption patterns that combines tightness with money and materialism. In this model different combinations of the two variables predict different forms of behaviour. For example, tightness with money plus high materialism foretells bargain hunting; tightness with money combined with low materialism predicts non-spending. Tatzel's (2002) approach of crossing money attitudes with personality variables seems to be a useful way to understand the consumption pattern of so-called self-deniers, too. Tightness plus high levels of individualism may predict non-spending. Tightness combined with low levels of individualism may result in self-denying behaviour, i.e. being extremely reluctant to spend money on oneself and at the same

time foolishly spending money on gifts, charitable donations, etc. Thus, a pure miser (a non-spender) must fulfil at least three requirements: being tight with money; being indifferent of material possessions; and being individualistic. Hence, an ideal survey study on miserliness would measure all three personality variables. However, accounting for two additional attitudinal variables means that the survey participants have to answer more test questions. Thus, obtaining a more accurate measure for miserliness typically comes at the cost of increasing the length of the questionnaire. As will be seen in the following section, none of the existing empirical studies on money retention has followed Tatzel's (2002) suggestion. Likewise, integrating three groups of attitudinal questions into a CVM questionnaire would be difficult, given that the length of a standard CVM interview already exceeds the patience and receptivity of many respondents.

Apart from the problem of finding an appropriate measure, researchers may face difficulties when asking money attitude questions in surveys. Many therapists have stressed that their clients are reluctant to talk about their money-related pathologies (see e.g. Trachtman, 1999, Goldberg and Lewis, 1978). Hence, survey respondents may also be unwilling to answer questions about their penny-pinching habits, especially in face-to-face interview situations. The factor structure of the Money Script Inventory (Klontz et al., 2011), introduced in section 4.2.2 for example, points to this potential difficulty in identifying penny-pinchers with the help of self-report questionnaires. The composition of the vigilance-subscale reveals that people who tend to retain their money ('Money should be saved not spent') are at the same time unwilling to talk about money-related issues ('It is not polite to talk about money'). The existence of a correlation between a person's reluctance to talk about spending and saving habits and his or her disposition to spend money in general further complicates the identification of misers in surveys. Keeping in mind these difficulties related to the identification of misers via attitude statements, empirical studies employing the MAS distrust-subscale and/or the MBSS retention-subscale are reviewed next.

5.3.2 Review of empirical studies on money retention

The objective of this section is to get more insights into differences in people's general money spending disposition. By means of a comprehensive literature review the question as to how common extreme tightness with money in the general population is shall be addressed. Furthermore, the relationship between money retention and socio-demographic characteristics, personality and cultural difference will be explored. Last but not least, empirical evidence regarding the influence of money retention on actual behaviour is in the focus of this section.

The results of several empirical studies that made use of the MAS distrust-subscale or the MBBS retention-subscale have been reviewed. In an attempt to comprehensively summarise the research on money retention over the last 30 years, 18 empirical studies have been identified and analysed. A summary of these studies can be found in Table 5-4 at the end of this section. A first issue to be noted is that the majority of research is based on rather small convenience samples, most prominently student samples. For this reason, the results of most of these studies cannot be generalised. Furthermore, reported figures like mean scores on a money attitude scale are not strictly comparable. This is because different authors selected different numbers and combina-

tions of items from the MAS and/or the MBBS. In addition to this, dissimilar answer scales were used in the empirical applications that are listed in Table 5-4; there is little consistency in the number of answer options and the endpoints of the Likert scales used.

Despite the long list of empirical studies on money attitudes, the question as to how common extreme forms of money tightness actually are in society cannot be easily answered. Unfortunately, none of the reviewed studies provides information concerning the distribution of answers to the money attitude statements pointing to miserliness. It would be useful to know how many respondents expressed high levels of agreement to statements such as 'Even when I have sufficient money I often feel guilty about spending money on necessities like clothes etc.' (MBBS) or ticked 'always' as their answer to the statement 'I automatically say, 'I can't afford it,' whether I can or not' (MAS). However, a few authors reported mean values for the score on the retention- or distrust-subscales. These mean scores range from 2.8 (Hanley and Wilhelm, 1992 using the MBBS-retention subscale) to 5.3 (Medina et al., 1996 using items from the MAS-distrust subscale) out of 7 points. In general, average scores are higher in studies that used MAS distrust-statements compared to studies that employed MBBS retention-statements. As already stressed in section 5.1.2, the number of items pointing to miserliness is higher in the case of the retention-subscale compared to the distrust-subscale. The distrust-subscale contains a considerable number of items referring to a person's distrust in salesmen in addition to the miser-items. The generally higher average scores on the distrust-subscale reveal that distrust is a more common money attitude than miserliness. The highest scores on MBBS-items were reported for surveys conducted in Asian countries (Hoon and Lim, 2001). This result is particularly interesting in view of the empirical part of the present work that is based on a survey study in People's Republic of China. As argued in the introduction, money retention may be of greater relevance in countries with Confucian tradition than in the western world. Furthermore, in most cases, the average score is lower than the midpoint of the Likert scale, i.e. below 4. This finding reveals that the different items indicating tightness with money were rejected rather than accepted by most respondents.

In addition to the mean scores reported by several researchers who made use of a money attitude inventory, some more insights regarding the distribution of extremely stingy people in the general population can be gained when looking at the results of empirical studies where the phenomena of miserliness was assessed in a more direct way, for example by means of a dichotomous question. For instance, 14% of the respondents who participated in Schmölders' (1982) household survey, conducted in the Federal Republic of Germany in the 1950s, were classified as misers. Empirical research on money pathology carried out by Furnham and colleagues (Furnham, 1996, Furnham and Okamura, 1999, Furnham et al., 2014) also gives some insights concerning the occurrence of penny-pinching in the general population. Furnham (1996) reported the following statistics for a self-administered pick-up survey: 22% of the 277 British respondents said 'yes' when asked 'Do you hold on, or hoard yoru money'; 14% agreed with the question 'Do you lie awake at night trying to figure out a way to spend less money and save more, even though you are already saving money?'. The same two questions were also part of a

recently implemented large-scale online survey; in this study average agreement with the two questions was significantly higher (35% and 22%, respectively, cf. Furnham et al., 2014), possibly because of the somewhat more anonymous interview situation. Taken as a whole, the results reported by analysts who attempted to account for personal differences in money spending habits reveal that miserliness is a side issue in society. However, all studies reported a significant share of survey participants who agreed with the items used to identify misers. Hence, although the true share of misers in the general population is certainly low, it seems to be of statistical importance. Another and maybe the most important conclusion that can be drawn from the review of existing studies on miserliness is that most of these studies are hardly elaborated and make use of poorly collected and low quantity survey data. Accordingly, the question whether the phenomenon of miserliness is of statistical relevance remains to be explored.

Several authors paid attention to factors potentially predicting tightness with money. A number of studies found gender to be correlated with the score on the retention- and the distrust-subscale. Females had significantly higher scores than men on the retention facet in two samples (Wilhelm et al., 1993, Lim et al., 2003). In contrast, females scored significantly lower than men on the distrust facet in two studies (Roberts and Sepulveda, 1999a, Baker and Hagedorn, 2008). Interpreting high scores on the retention facet in terms of miserliness and high scores on distrust facet in terms of suspicious attitudes towards salesmen, the first attitude seems to be more typical for women while men appear to be more likely to complain and bargain when making a purchase. There is mixed evidence on the relationship between age and tightness with money. Furnham (1984) found a positive correlation between age and the retention score, Baker and Hagedorn (2008) reported a negative correlation between age and a score that was based on answers to items selected from the retention- and the distrust-subscale. Six studies which focussed on the relationship between income and tightness with money have been identified (Yamauchi and Templer, 1982, Furnham, 1984, Roberts and Sepulveda, 1999a, Baker and Hagedorn, 2008, Hayhoe et al., 2012, Wiepking and Breeze, 2012). In all six studies income is a weak and often insignificant predictor of a respondent's score on the retention or the distrust-subscale. Yamauchi and Templer's (1982: 528) early finding that tightness with money is 'essentially independent of a person's income' was thus reproduced in several other surveys. This means that people who are objectively better off or even affluent are not automatically less tight with their money than their counterparts. This result also suggests that misers can be found in both poor and wealthy groups of society.

A few researchers investigated the relationship of tightness with money and other psychological variables. Among other things, the score on the retention-subscale was found to be positively correlated with conservatism (Furnham, 1984) and face concern (Lim, 2003). Wilhelm et al. (1993) concluded that subjects scoring higher on the retention-subscale reported lower levels of financial satisfaction. Shafer (2000) looked at several personality variables and their relationship with money attitudes. To account for different dimensions of money attitudes the author employed three different inventories (MBBS, MAS and MES). Unfortunately, there is insufficient

information concerning the exact items that constituted the money attitude facets analysed in this paper. Shafer (2000) reported significant effects of the Big Five personality traits extroversion, conscientiousness and neuroticism on two somewhat nebulous money attitude variables labelled 'Distrust Money is Evil' and 'Anxiety Worry'. Furthermore, he found a negative relationship between generosity and these two variables. Tatarko and Schmidt (2012) scrutinised the relationship of several money attitude facets and social capital. The authors found that among all considered money attitude variables the retention facet had the strongest negative effect on levels of individual social capital. They concluded that greater levels of social capital may decrease a person's desire to accumulate money.

Curiously, there is only little research concerning the effect of self-report money retention on actual behaviour. Hanley and Wilhelm (1992) found that compulsive buyers scored slightly higher on the money retention-subscale than so-called normal consumers. Khare (2014) also reported that high scores on the distrust-subscale were positively related to a repetitive urge to shop or spend. These results anew point to an issue discussed in the previous section, namely that self-report tightness with one's financial resources does not always result in non-spending. Based on questions regarding money attitudes and saving habits, Lim and Teo (1997) discovered that respondents scoring higher on the retention variable were more likely to save money regularly. Hayhoe et al. (2012) found a similar result when comparing scores on the distrust-subscale to statements about saving habits. Finally, the biennial 'Giving in the Netherlands Survey Panel' encompasses several statements of the MBBS. Wiepking and Breeze (2012) showed that the score on the retention-subscale had a significant negative effect on the total amount donated to charitable organisations in 2007. Using an OLS regression model they showed that the retention variable was a more powerful predictor for donations than actual financial resources (home ownership, after-tax household income and income from wealth). They concluded that 'money perceptions should be considered as important dispositional characteristics for predicting donations' (Wiepking and Breeze, 2012: 21).

In sum, the results of most empirical studies on money attitudes show that the miser is an uncommon character in society but that individual difference in spending vs. hoarding one's money are substantial. The reviewed survey data provides mixed results regarding the factors which influence a person's self-reported tightness with money. Some studies found gender, national origin, personality traits and other psychological constructs to be correlated to this facet of money attitudes, but there seems to be no simple and systematic relationship between money spending dispositions and demographic or other psychological variables. Tightness with money mostly decreases with higher income levels but most researchers reported only a weak relationship between a person's actual financial resources and his or her score on the relevant attitude items. Unfortunately, even after having carefully collected and scrutinised the results of dozens of empirical studies, little can be said concerning the relevance of self-report miserliness on actual behaviour. However, Wiepking and Breeze's (2012) analysis of the impact of money attitudes on charitable giving, which is based on a large random household sample, points to the relevance of

this psychological variable for the prediction of actual spending decisions. Since the MBBS-retention variable has a significantly negative effect on annual donations in this study it is expected that a similar result would be obtained for other decisions and acts involving money. As argued in the next section, tightness with money may be a useful predictor variable for respondents' answers to the payment question in contingent valuation surveys.

Table 5-4: Surveys on money retention (1982-2014)

Empirical studies	Scale and items used[1]	Mean money attitude score[2]	Sample size	Subjects	Location	Relationship with other variables	Correlation with income
Yamauchi and Templer (1982)	MAS (1)-(7)	4.119	300	Diverse	Los Angeles and Fresno, California	Paranoia (+), Machiavellianism (+), status-concern (+), time competence (-), obsessionality/anal character (+)	-0.060
Furnham (1984)	MBBS (1)-(6)	3.417	256	College students	Great Britain	Age (+), Alienation (+), Protestant Work Ethic (+), Conservatim (+)	Not sig.
Hanley and Wilhelm (1992)	MBBS (1)-(7)	Compulsive buyers: 2.780 Others: 2.440	143	Diverse	Arizona, Colorado, Detroit, Michigan	Compulsive buying (+)	N/A
Wilhelm et al. (1993)	MBBS (1), (2), (3), (7)	N/A	559	Household heads	Arizona and California	Female (+), Financial satisfaction (-)	N/A
Medina et al. (1996)	MAS (1)-(4), (6), (7)	Anglo-American: 5.28 Mexican: 5.26	1,132	Mexican-American and Anglo-American former students		No significant relationship with ethnic background	N/A
Lim and Teo (1997)	MBBS (1)-(3)	N/A	152	College students	Singapore	Ability to save money (+), anxiety (+) No relationship with financial hardship	N/A
Roberts & Sepulveda (1999a,b)	MAS (1), (3), (5), (6)	N/A	275	Diverse	Monterrey, Mexico	Female (-), compulsive buying (+)	Not sig.

Empirical studies	Scale and items used[1]	Mean money attitude score[2]	Sample size	Subjects	Location	Relationship with other variables	Correlation with income
Hayhoe et al. (1999)	MBBS (4), (7) & MAS (5)	N/A	426	College students	Kentucky, Oneonta, Iowa, Rhode Island	Possession of a credit card (-)	N/A
Shafer (2000)	MBBS MAS	N/A	200	College students	California	Big Five traits extroversion (-), conscientiousness (-) and neuroticism (+); generosity (-), status concern (+)	N/A
Hoon and Lim (2001)	MAS (1) MBBS (3)	Singaporeans before and after crisis: 3.57/3.640 Thais after crisis: 4.020	325	College students with previous work experience	Singapore and Bangkok	No relationship with nationality and economic recession	N/A
Lim et al. (2003) Lim (2003)	MBBS (1)-(3)	N/A	305	Singaporean-Chinese working adults	Singapore	Female (+), Face concern (+), Confucian work ethic (-)	N/A
Masuo et al. (2004)	MBBS (1), (2)	Asians: 4.920 Asian Americans: 3.675	290	Asian and Asian-American college students	Kora, Japan, U.S.	National origin	N/A
Watson et al. (2004)	MAS (1), (3), (5), (6)	Men: 3.304 Women: 3.201	418	College students	Tennessee	Narcissism (+), Religiousness (+)	N/A

Empirical studies	Scale and items used[1]	Mean money attitude score[2]	Sample size	Subjects	Location	Relationship with other variables	Correlation with income
Baker and Hagedorn (2008)	MAS (1), (2), (3), (4), (5) MBBS (1), (2), (5)	N/A	200	Diverse (random telephone survey)	Canada	Education (-), Age (-), Female (-)	-0.150*
Hayhoe et al. (2012) Hayhoe and Gutter (2012)	MAS (1), (3), (6), (7)	4.389	749	Diverse	U.S., nation-wide	Financial management (+), saving regularity (+)	Not sig.
Wiepking and Breeze (2012)	MBBS (1)-(4)	3.584	1,866	Representative household sample	Netherlands	Amount donated to charity(-)	-0.119*
Tatarko and Schmidt (2012)	MBBS (1), (3), (7)	N/A	634	Diverse	Russia	Social capital (-), Age (+), education (-)	N/A
Khare (2014)	MAS (1), (5), (6), (7)	N/A	409	Diverse (Mall-stop survey)	India	Compulsive buying (+)	N/A

[1] MAS items: (1) I argue or complain about the cost of things I buy. (2) It bothers me when I discover I could have gotten something for less elsewhere. (3) After buying something, I wonder if I could have gotten the same for less elsewhere. (4) I automatically say, 'I can't afford it,' whether I can or not. (5) When I buy something, I complain about the price I paid. (6) I hesitate to spend money, even on necessities. (7) When I make a major purchase, I have the suspicion that I have been taken advantage of
MBBS items: (1) I often say 'I can't afford it' whether I can or not. (2) Even when I have sufficient money I often feel guilty about spending money on necessities like clothes etc. (3) I often have difficulty in making decisions about spending money regardless of the amount. (4) I prefer to save money because I'm never sure when things will collapse and I'll need the cash. (5) I often buy things that I don't need or want because they are in a sale or reduced in a sale or reduced in price. (6) I often feel inferior to others who have more money than myself, even when I know that they have done nothing of worth to get it. (7) In making any purchase, for any purpose, my first consideration is the cost.
[2] Mean attitude score: A person's score on the distrust facet or the retention facet is calculated as the sum of his or her answer choices on the Likert scale and divided by the numbers of items. Using a 7-point Likert scale the score's range reaches from 1 'completely disagree' to 7 'completely disagree' for studies using the MBBS and from 1 'never' to 7 'always' for studies using the MAS. In the table scores have been converted to a 7-point format whenever the original study employed a different response format (e.g. 5-point Likert scale).

5.4 Consequences for CVM studies

In section 5.2 the question how a person's disposition to spend money in general might affect his or her WTP for environmental goods was approached from a theoretical perspective. It has become evident that, under certain circumstances, money attitudes affect the meaningfulness and interpretability of WTP estimates. This would be the case if a considerable number of people applied lexicographic decision rules that preclude any trade-off between money and environmental goods. The WTP of these individuals is well-defined, i.e. it is zero, but not interpretable in terms of the utility accruing from the environmental project in question. However, the concept of lexicographic preferences fits, if at all, the stereotype of a miser, i.e. a strict non-spender. The results of empirical studies on money attitudes reveal that the share of extremely stingy people in the general population is rather low but that it is of statistical importance. Therefore, miserliness should not be neglected in survey-based environmental valuation studies. Furthermore, an individual's disposition to spend money in principle appears to be a personality variable of its own right which is expected to affect the way in which people act in situations involving money. There is at least some empirical evidence that this attitudinal variable matters for people's saving and spending habits. In view of the growing interest in psychological research on economic behaviour, it appears somewhat surprising that money attitudes have never been discussed in the context of contingent valuation. Given this paucity of research, the relevance of money spending dispositions for the results of CVM studies shall be discussed in this section.

5.4.1 Relevance of money retention for stated WTP

At first glance, the hypothesis that the WTP statements of stingy people differ from the WTP of generous people appears to be quite plausible. Given the everyday experience, it can be expected that there is a negative relationship between stated WTP and miserliness. It would be rather surprising if a person who fiercely retains his or her money in everyday life suddenly agrees to contribute a high amount of money to an environmental project. At the same time, the effect of money spending dispositions in general and miserliness in particular on the answers to payment questions, i.e. hypothetical spending, can also be doubted. It is to be noted that the good which is 'sold' in a CVM interview differs from the goods traded in real markets, i.e. the commodities for which people spend money in everyday life; they are (quasi) public goods. Due to the particular payment mechanism through which environmental goods are provided in a CVM project scenario, a person's decision of spending money does not only have an effect on his or her personal utility but also on other people's wellbeing. Well-designed CVM surveys typically give respondents the impression that their personal contribution alters the probability that the environmental project of concern is realised. Thus, unlike in the case of refraining from spending money on private goods, a person's refusal to contribute money to an environmental project decreases the probability that other people can enjoy the benefits accruing from that project. Hence, a stingy person who is concerned about his or her fellow citizens' wellbeing may act differently when it

comes to the contribution to a public good than in common purchase situations. Given several psychotherapists' reports, it can hardly be assumed that all people who neurotically hold on to their financial resources are unsocial egoists who do not care about other people's wellbeing (see for instance Goldberg and Lewis' (1978) description of the self-denier, section 4.1.2). For this reason, it can be hypothesised that the public good characteristics of environmental projects confound a person's usual spending habits. The psychological pain that misers experience in usual purchase situations may be mediated or even offset by feelings of altruism, including pure or impure forms of it (e.g. the so-called warm-glow of giving, cf. section 2.3.2). Furthermore, the presence of an interviewer in face-to-face CVM surveys makes the decision of spending or not spending different from a real market situation. With the presence of an interviewer a miser has to disclose his or her inhibition against spending money by actively stating that he or she is unwilling to contribute money to the environmental project in question. It can be speculated that speaking out loud that one's WTP is zero is a more embarrassing experience than simply leaving the supermarket with an empty trolley or closing down the website of an online store. Similarly, willingness to please the interviewer, social norms and fears of giving answers which are considered to be incorrect by the supposed sponsors of the survey (i.e. the government in many cases) may prevent a miser from admitting his or her true, presumably zero WTP.

Finally, and most importantly, the payment situation in a CVM interview is hypothetical. Respondents are simply asked to state how much money they would give up in exchange for an environmental improvement but no actual transactions are made. Thus, it may be the case that money attitudes do not matter at all for people's choices on contingent markets. A miser who hardly ever spends money on actual markets might state a positive WTP because he or she does not believe that there will be an actual payment subsequent to the survey. Similar to the fact that many CVM studies fail to identify a significant income effect, it may be the case that money spending dispositions do not affect respondents' answers to WTP elicitation questions. At the same time, the absence of an income effect in multiple CVM studies could also be an indicator of the limited relevance of people's objective financial situation for their (un)willingness to pay money for environmental goods and calls for the analysis of psychological variables such as money attitudes. As pointed out by behavioural economists as well as social psychologists, not only a person's ability to spend money, i.e. disposable income and wealth but also, and perhaps to an even larger extent, a person's disposition to spend money in general matters for individual consumption, saving and investment decisions. From this perspective, it can be speculated that the money attitude facet considered here is at least on an equal footing with the income variable. Moreover, the argument regarding the hypothetical nature of the payment situation in a CVM interview can be partly refuted. It has become a broadly accepted guideline that the payment scenario should be realistic, that it should resemble a real market situation as closely as possible and that respondents should perceive the CVM survey as consequential (c.f. Carson and Groves, 2007, Arrow and Solow, 1993). Thus, in the case of a well-designed CVM survey it is reasonable to expect that most respondents perceive the payment situation in a way that resembles an

actual purchase situation. Naturally, respondents still give hypothetical answers to hypothetical questions but this does not necessarily mean that they completely ignore their feelings related to spending money.

Hence, although there are a number of arguments which put in question the relevance of money attitudes for WTP statements, there are also good reasons to stick to the hypothesis that money retention affects the results of CVM surveys. In principle, there are three possibilities regarding the impact of money attitudes on the answers to a WTP elicitation question: (1) People behave the same way as in situations involving actual spending. This to say that a person's WTP is negatively related to his or her tendency to retain his or her money. (2) Since no actual transactions are made during a CVM interview, money attitudes do not matter at all for a person's WTP. A miser, for example, may not feel the usual conflict over spending money and will state a WTP which reflects his or her appreciation of the environmental improvement in question. (3) Money attitudes are in conflict with other factors which are irrelevant for most spending decisions in everyday life. Some of these factors are directly related to the environmental good in question (altruism, environmental attitudes, etc.), others are merely a by-product of the interview situation (e.g. the wish to save face in front of the interviewer). Depending on which factor dominates, money attitudes may or may not have an observable effect on stated WTP. For example, a person who attaches great importance to accumulating money but who wishes to hide his or her miserly attitudes from the interviewer might state a positive WTP. In contrast, there may be people with very positive environmental attitudes, who are in favour of any environmental protection project. However, they are too stingy to tolerate any loss of money so that they will always state a zero WTP. As will be shown in the following section, none of the three possible outcomes is desirable in terms of the validity of CVM data.

5.4.2 Validity of CVM data

As concluded in the previous section, individual differences in the willingness to spend money in general may or may not affect people's answers to hypothetical payment questions. The question arises whether the validity of individual WTP statements and the validity of CVM data as a whole are affected in the one or the other case. As explained in section 2.3.2, validity refers to the degree to which value estimates assessed in stated preference surveys measure the true value that individuals assign to the environmental improvement in question. Validity assessments usually consist of checking the content, convergent and criterion validity of the results derived from a particular CVM survey. While omitting the aspect of content validity[14], the role of money attitudes for construct and convergent validity of stated WTP as well as for the overall quality of CVM data will be analysed next.

[14] Since this form of validity merely refers to the degree to which a CVM study has been conducted in line with the general guidelines for a satisfactory questionnaire design and survey implementation, it will not be further considered in the present section. No attempt will be made to question or revise the widely accepted recommendations concerning the questionnaire design, survey mode, sampling issues and data analysis, regardless of whether money attitudes matter for the outcome of a CVM survey or not.

One of the key assumptions in CVM research is that answers to valuation questions are determined by respondents' preferences and that these preferences are consistent with standard economic theory (see Bateman et al., 2002: 297). WTP for a prospective environmental improvement is interpreted as the amount of market consumption an individual could give up without being worse off than in the status quo situation. Due to the fundamental assumption that environmental quality can be substituted for market consumption (and hence for money representing the worth of various commodities) in terms of utility, an individual's preferences can be represented by indifference surfaces which show the different combinations of market goods and environmental goods which generate identical levels of utility. Accordingly, there is always some amount of money which could compensate for a change in environmental quality in terms of utility and there is always some level of environmental quality which could compensate for a change in income. Indifference about alternatives is, however, a particularity of the kind of preference ordering on which contemporary welfare economics are based. In contrast to that, substitutability among the components of different bundles of goods is not always given for other concepts of preferences and choice. Most importantly, the concept of lexicographic orderings, which appears suitable to theoretically describe the behaviour of misers, precludes the case that individuals are indifferent about alternatives, i.e. that they are willing to make trade-offs between goods like environmental quality and money. Hence, given the possibility that there is no environmental improvement that would compensate a miser for a loss of money, the question arises what this implies for a miser's answer to a valuation question in a CVM interview. As theorised in section 5.2.2, a miser who applies a strict lexicographic rule will always state a zero WTP (or 'no' in the case of a referendum question). More realistically, it is expected that even a miser ignores minimal changes in his or her money balance, meaning that the person may state an extremely low but positive WTP amount (or answer 'yes' when asked to pay a very low amount of money). In both cases, stated WTP reflects the miser's true WTP which must be, given the lexicographic ordering in which money precedes environmental quality, (close to) zero. Nevertheless, although being true expressions of preferences, WTP statements which are based on lexicographic decision rules threaten the **construct validity** of WTP data because they do not measure what a CVM practitioner intends to measure. Same as in the case of an individual with standard neoclassical preferences, a miser may be better off subsequent to an environmental improvement. However, his or her answer to the payment question does not reveal this potential increase in utility. The miser's WTP will be (close to) zero, irrespective of how large the prospective utility increase would be.

Miserliness, in the sense of addictive behaviour, may also affect several indicators for the construct validity of WTP estimates, such as their responsiveness to price and scope. A lexicographic decision rule implies that an individual only focuses on one particular component of an alternative; all other components are irrelevant for his or her choice. This means that the WTP of a person who is exclusively focussed on the monetary attribute of the two alternatives to which the valuation question of a CVM survey refers to (the status quo, i.e. no environmental

improvement and no payment vs. the project scenario, i.e. environmental improvement and payment) is completely unrelated to the environmental project to be valued, including the scope and scale of the project. Furthermore, in spite of very low, impalpable amounts of money, it is expected that a miser's answer to a referendum question is unaffected by the bid level, too. This is because the lexicographic decision rule implies that misers will state 'no' as soon as they perceive the loss of money implied by their choice as significant, regardless of whether this loss is small or huge.

Lexicographic decision rules as well as WTP statements' irresponsiveness to bid levels and scope would be reasons for discarding the answers of misers before calculating the sample's average WTP. However, in addition to the general issues of discarding the answers of certain groups of respondents from the data, such as decreasing the sample size and reducing the sample's representativeness, correcting for the 'miser bias' is likely to negatively affect the **convergent validity** of WTP estimates. As explained before, researchers commonly test for convergent validity by comparing the average value assessed in a CVM survey to the average value assessed in a simulated market experiment. Clearly, observing a negative effect of money retention on WTP appears to be more plausible in a simulated market experiment than in a hypothetical CVM interview. This is because actual transactions are only made in the former setting but not in the latter. Thus, a relatively weaker effect of this money attitude facet on stated WTP could be one of the reasons for the frequently reported divergence of values assessed with the help of hypothetical questions and those assessed in experimental settings. Since the WTP statements of most misers are, presumably, very low or zero, discarding them would increase the gap between actual and stated WTP and hence threaten the convergent validity of the CVM data. From this perspective, deleting the answers of stingy respondents is not recommendable. Rather than discarding part of the collected data, CVM practitioner should treat money attitudes in a similar way as protest bids and other potential biases. In a first step, they should check whether attitudes towards spending money significantly affect the WTP estimate; and in a second step, they may inform the recipients of the survey results about this possibly biasing effect.

Finally, the existence of respondents with a strong inhibition against spending money in general may also affect the **overall quality** of the information gathered in CVM interviews. In psychological literature, money-related questions are often described as a taboo topic (cf. e.g. Trachtman, 1999, Goldberg and Lewis, 1978, Furnham, 2014). Many people dislike talking about money-related issues, especially those suffering some money-related pathology. For example, Klontz et al. (2011) found that people who tend to hoard their money are also more likely to consider money-related questions as private and impolite. For this reason, it may be the case that respondents with strong inhibitions against spending money perceive the key question of a CVM questionnaire, namely the elicitation question regarding their willingness to contribute money to a certain environmental project, as inappropriate, embarrassing or even insulting. Refusing to answer the payment question and/or breaking off the interview after having been asked the payment question is therefore expected to happen more frequently in the case of misers than

for respondents with more common money spending dispositions. In addition to that, protest against the payment scenario is expected to be more widespread in the group of misers. For example, misers may perceive the idea of collecting money from ordinary people in order to finance an environmental project as more unfair than respondents who do not feel such great pain of paying. Furthermore, it can be speculated that a miser's motivation to answer further questions decreases subsequent to the payment question. The anger about being asked to give up money for some environmental project may persist when having to answer those questions which typically follow the elicitation question, namely debriefing questions, questions regarding a respondent's household and auxiliary questions. It can be speculated that misers, compared to other respondents, are less willing to think deeply about follow-up questions, become impatient and use strategies to end the interview as soon as possible. For example, monotonic answering or not following the instruction given by the interviewer (e.g. answering 'yes' or 'no' instead of considering some precise answer options) is expected to be of particular concern in the group of misers. Taken together, there are several reasons to doubt that a person who generally hates spending money is a very pleasant respondent of a CVM interview. In addition to giving the interviewer a hard time, the answers given by stingy respondents may be less consistent and less accurate as compared to other survey participants' responses. These issues add to the importance of treating the answers of misers with particular caution when analysing the data of CVM surveys.

So far, only the most extreme case of money retention has been considered. However, miserliness is likely to be an exceptional case. Given everyday experience and the outcome of empirical studies on money attitudes, the share of respondents who feel no conflict over spending money at all is likely to be greater than the proportion of misers in the general population and the majority of people are likely to be situated somewhere in between of the two extremes. For this reason, looking at money spending dispositions as a continuous variable which can take different levels reaching from generous to stingy appears to be of greater relevance than simply scrutinising the extreme, pathological case. Intuitively, one would expect that different levels of willingness to spend money in general do have an effect on WTP. Ceteris paribus, the more generous a respondent is, the higher is his or her WTP will be. Thus, not discovering a negative relationship between money retention and stated WTP would not be consistent with intuitive expectations and may be interpreted as an indicator of a lack of validity.

All in all, money spending dispositions in general and miserliness in particular appear to be an interesting phenomenon in the context of CVM research. Neither the existence nor the absence of a relationship between money attitudes and WTP statements is desirable in terms of the validity of the values assessed in CVM surveys. No relationship between a person's attitudes towards spending money in general and his or her WTP may be the result of a poor, i.e. unrealistic and implausible, design of the payment scenario. A negative relationship between money retention and stated WTP appears to be plausible and hence desirable at first glance. However, the group of extremely stingy respondents within the overall sample merits, although it might be rather

small, particular attention. The WTP statements of misers will be systematically biased in the case that these people use lexicographic decision rules when answering the payment question. Furthermore, it is expected that misers are somewhat awkward respondents whose answers may threaten the overall quality of the data gathered in a CVM survey. The analysis of money attitudes is also interesting in view of the fact that many CVM studies lack a significant income effect. Given the results of existing studies which focussed on the effect of money attitudes on financial behaviour it may be the case that psychological factors like a person's attitudes towards spending money confound, mediate or even dominate the effect of any variable referring to a person's objective ability to spend money, like disposable income or wealth.

5.4.3 Research questions and hypotheses

Research on money attitudes has become increasingly popular in social psychology over the last decades. By contrast, the topic of how people differ in their perceptions of money and their habits in using it has attracted hardly any attention in economics. There are, however, an increasing number of theoretical and empirical contributions which stress the importance of money attitudes on decisions involving money, like spending and saving (e.g. Wiepking and Breeze, 2012, Hayhoe et al., 2012, Rick, 2008). As explained at the beginning of this chapter, certain facets of money attitudes are likely to matter for the results of CVM surveys. Given the paucity of research on money attitudes in economics in general and the presumably interesting role of money attitudes for WTP statements in CVM surveys in particular, a comprehensive empirical analysis of the role of money attitudes in CVM surveys shall be provided at the end of this dissertation. The focus lies on the money attitude facet which has been identified as the one which appears to be the least compatible with economic theory, namely neurotic money retention. In addition to scrutinising the effect of this attitudinal variable on WTP statements, particular attention will be paid to the extreme case of money retention, which is miserliness. In the empirical application presented in the next chapter, the following research questions shall be answered:

a) How common is pathological behaviour with money in a representative population sample?
b) How does money retention relate to demographic and socio-economic variables?
c) Are misers more likely to hold negative attitudes towards the environmental project and the associated payment mechanism presented during a CVM interview than other respondents?
d) Are misers less motivated during a CVM interview as compared to other respondents?

In addition to this general analysis of the role of money retention in CVM surveys, the following research questions regarding the relationship of this facet of money attitudes and stated WTP shall be explored:

e) Does money retention systematically relate to stated WTP?
f) What is the magnitude of the (potential) effect of this money attitude facet on WTP as compared to more objective variables like disposable income?
g) How robust is the (potential) effect of money retention on WTP?

These research questions will be answered based on the results of a representative CVM survey conducted in Beijing in 2013. Money spending dispositions were measured by means of a modified variant of Furnham's (1984) money retention scale. Scores on this scale will be used to construct a money attitude variable which can be integrated into the econometric analysis of WTP statements. Furthermore, the relationship between the money attitude variable and other factors, such as attitudes towards the environmental project, the related payment as well as a respondent's overall motivation during the interview will be explored.

Furthermore, based on the theoretical considerations presented in section 5.2 and the empirical studies which have been reviewed in section 5.3, several hypotheses shall be formulated and tested. Regardless of the way of modelling the preference for accumulating money, WTP is, theoretically, positively related to an individual's disposition to spend money in general. Furthermore, empirical studies provide at least some evidence that stingy people are less likely to engage in actual transactions and spend, on average, significantly less money on diverse purposes, including for example donations to charity. It is expected that similar results will also be obtained in a well-designed CVM survey with a credible and realistic payment scenario. Furthermore, as theorised in section 5.2, the WTP of most people with an extreme inhibition against spending money in general should be (close to) zero. Accordingly, money retention is expected to not only affect the amount of money somebody is willing to contribute to an environmental project but also the likelihood of stating some positive amount at all. Finally, predictions regarding the answer behaviour of the group of respondents with an extremely strong inhibition against spending money can be made. As explained in section 5.2.2, the concept of lexicographic preferences represents the binary choices made by a stereotypical miser very well but poses problems in terms of the interpretability of WTP statements. This theoretical model predicts that a miser's WTP is always zero, irrespective of the kind and magnitude of the environmental improvement and the associated monetary fee. Thus, if most misers act in line with a lexicographic decision rule, which assigns absolute priority to increasing one's money holdings, when answering the contingent valuation question, the WTP of misers must be, on average, zero. These expectations lead to the following three hypotheses:

(H1) WTP is lower the higher an individual's tendency to retain his or her money.
(H2) Higher levels of money retention increase the likelihood of stating a zero WTP.
(H3) The WTP of misers is, on average, not significantly different from zero.

The first two hypotheses are quite intuitive. Hence, finding no evidence for them would be somewhat troubling in view of the validity of a CVM survey. If the null hypothesis cannot be rejected neither in the case of H1 (i.e. no negative effect of money retention on the stated WTP amount) nor of H2 (i.e. no negative effect of money retention on the probability of stating some positive amount) overall WTP risks to be biased. This is because the complete absence of a negative impact of money retention on stated WTP is likely to be the consequence of an implausible and unrealistic payment scenario. Naturally, besides a poorly designed payment scenario, the absence of this effect could also be due one or several of the other aforementioned reasons, such as the public good characteristics of environmental goods and the presence of an interviewer.

Finding evidence for the third hypothesis would be of great concern, too. An overall WTP of zero within the group of misers would contradict one of the key assumptions underlying the theoretical concept of environmental valuation, namely the idea that all people consider money and environmental quality as substitutes. If misers do not 'play the game', this is to say if they refuse to make a trade-off between money and environmental quality, their stated WTP cannot be interpreted in the usual way and the overall value estimate may be biased. As already mentioned, the question whether or not the WTP statements of misers imply a downward bias of overall WTP critically depends on the distribution of misers in a population. Although most existing empirical studies on miserliness reported a statistically significant share of misers in the populations under considerations (i.e. greater than 5%), it may still be the case that the proportion of misers is negligible in some other populations. In the next chapter the research questions presented above shall be answered and the three hypotheses will be analysed based on a large and representative sample of the residents of urban Beijing.

6 Empirical application

As argued in the previous chapter, a person's disposition to spend money is likely to influence his or her answer to the WTP question in a CVM survey. Miserliness has been identified as a particularly problematic extreme of this attitudinal variable and is expected to affect the validity of individual WTP statements. At the same time, the relevance of money spending dispositions in general and miserliness in particular for CVM surveys can also be doubted. This is mainly because the payment scenario presented in a CVM interview is purely hypothetical. Typically, respondents are simply asked whether or not they would be willing to contribute a certain amount of money to the environmental project in question. Since no actual transactions are made a person's money spending disposition may be irrelevant for his or her answer to the elicitation question. In addition to that, the share of misers in the general population may be insignificantly small. At the same time, these arguments against the relevance of money spending dispositions are purely speculative. So far, money attitudes have, to my best knowledge, never been systematically investigated in the context of environmental valuation. Moreover, there are only a few empirical studies analysing the effect of money retention on economic behaviour and hardly any of them have used representative population samples. This lack of research adds to the relevance of measuring and analysing people's attitudes towards spending money in a stated preference study. This chapter investigates the role of money spending dispositions in CVM surveys empirically. The research questions and hypotheses presented in section 5.4.3 will be analysed based on the results of a CVM survey conducted in Beijing in 2013. This survey was part of a Sino-German research project on sustainable oasis management in the Tarim Basin. Section 6.1 introduces the background of this project. In section 6.2 the preparation and implementation of the CVM survey will be described in more detail. The focus of section 6.3 lies on the general survey results, followed by a comprehensive analysis of money spending dispositions in section 6.4. At the end of the chapter, the empirical findings regarding the role of money attitudes in CVM surveys will be discussed.

6.1 Environmental valuation of more sustainable oasis management in the Tarim Basin

The statistical analysis which will be presented in the following sections is based on data which was collected in the context of the Sino-German research cooperation SuMaRiO (Sustainable Management of River Oasis along the Tarim River / China, BMBF-Funding Measure 'Sustainable Land Management', LLA2-02). The overall goal of the SuMaRiO project is the elaboration of alternative land use strategies for a water-scare region in Northwest China in order to facilitate a more sustainable development of the region. The researchers involved in subproject 5.1.4 'Contingent valuation of more sustainable oasis management in the Tarim Basin' jointly led by Prof. Dr. Michael Ahlheim (University of Hohenheim) and Prof. Dr. Oliver Frör (University Koblenz Landau), carried out a CVM survey on the social benefit of more sustainable oasis

management in the Tarim Basin. I was responsible for the fieldwork in China thereby enjoying the support of our Chinese partners Prof. Dr. Jiang Tong (Chinese Meteorological Administration) and Luo Jing Ph.D. (Chinese Academy of Social Sciences). The next sections provide some general information on the project area as well as an introduction to SuMaRiO and the associated contingent valuation survey.

6.1.1 The Tarim Basin: social, economic and environmental facts

The Tarim Basin owes its name to the Tarim River which is the longest continental river in Central Asia. The Tarim Basin is the world's most remote area from the oceans and the local climate is extremely arid with little precipitation and high evaporation rates (c.f. Huang et al., 2010). Since rainfall is extremely rare in this area, the Tarim River and its tributaries are the major water source for all kinds of human activity and for the natural ecosystems in the Tarim Basin (c.f. Thevs, 2011). The Tarim Basin comprises the southern part of Xinjiang Uyghur Autonomous Region, China's largest administrative division located at the borders of Afghanistan, India, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia and Tajikistan. In spite of the enormous size of Xinjiang – 1.66 million km^2, which is about one sixth of China's landmass – less than 5% of the region is habitable; the remaining 95% are covered by deserts and mountains. Land is particularly scarce in the Tarim Basin which is dominated by the Taklimakan Desert so that about half of the eight million inhabitants live in oasis cities along the Tarim River.

There are unique but highly vulnerable dryland ecosystems along the Tarim River. The services provided by riparian forests, reed beds, grasslands and shrub vegetation enhance the living conditions of the inhabitants of the Tarim Basin. Most importantly, the riparian forests build a 'green corridor' which prevents that the Taklimakan Desert merges into the southern part of the Gobi Desert (c.f. Halik et al., 2005). Furthermore, farmers use the riparian forest and the grasslands as pasture for hay-making to feed sheep and goats. The riparian forests and shrubs also protect the cities and villages in the Tarim Basin from dust and sandstorms. Certain herbs growing in the grasslands are traditionally used as natural medicines. The flooded areas of the riparian forests and reed beds contribute to the recharge of groundwater with fresh river water, which local people use as drinking water and for irrigation. Furthermore, the riparian forests attract visitors from all parts of China and therefore have high touristic and educational value. Taken together, the dryland ecosystems of the Tarim Basin provide a considerable number of valuable ecosystem services to the Chinese society.

Traditionally, the Tarim Basin was populated by Muslim Turkic speaking farmers that are today known as the Uighur people. At the end of the nineteenth century, Chinese troupes occupied the area which the Uighurs called 'Eastern Turkestan' by that time. The Chinese annexed it to the state territory of the Middle Kingdom and former Eastern Turkestan obtained its Chinese name 'Xinjiang', which means 'new border'. In the first half of the twentieth century, Uighur separatists made several attempts to become independent again. The Independent Republic of Eastern Turkestan was established twice (1933 and 1944) but Mao Zedong's troupes put an end to Uighur nationalism in 1949 when People's Republic of China was founded (c.f. Dillon, 2004).

At that time, the Tarim Basin was scarcely populated and, compared to other parts of China, economically underdeveloped. Since the 1950s, the Chinese government has promoted the economic development of Xinjiang, accompanied by an enormous influx of Han Chinese settlers. Population growth, the expansion of agricultural activities, especially the water-intensive cotton production, and industrial development have caused a substantial loss of water resources in the lower reaches of the Tarim River leading to severe environmental deterioration. An increasing number of sandstorms, dust days, progressing desertification of the landscape and loss in biodiversity are the result of the advancing deterioration of the natural riparian ecosystems (c.f. Thevs, 2011, Ahlheim et al., 2013b). Although the impact of global warming on the region is debated among researchers, several climate experts predict rising temperatures, changes in seasonal precipitation and melting of glaciers (cf. Chen et al., 2013). Under these circumstances, the Tarim River may dry out completely. A complete desiccation of China's longest inland river would have disastrous consequences because it would imply that the Taklimakan Desert and the southern part of the Gobi Desert grow together. Hence, the realisation of more sustainable water management and land use strategies in the Tarim Basin is of national concern and has attracted the interest of the international scientific community since long.

6.1.2 SuMaRiO – a Chinese-German research cooperation

SuMaRiO is a multidisciplinary research project involving 11 German and 6 Chinese universities and research institutes. The project was initiated in 2011 and is funded by the Federal Ministry of Education and Research of Germany. The consortium of researchers aims to develop practical solutions to the economic, social and environmental issues arising from the ongoing loss of water resources in the Tarim area. Of central concern is the preservation of the natural vegetation along the Tarim River, which has been traditionally subordinated to the economic development of the region. An explicit goal of SuMaRiO is the integration of the natural ecosystem services into land and water management decisions (cf. SuMaRiO, 2015, Rumbaur et al., 2015).

The SuMaRiO research project is organised in different groups of scientists, which have focused on several interrelated fields of research. During the project's research phase (2011-2014), a first group of researchers investigated issues of future water availability by observing and modelling changes in the cryosphere like glacier melting, forecasting precipitation and estimating the impact of climate change on water discharge of the Tarim River. Another group was concerned with the improvement of the irrigated farming systems by analysing water demand and water quality in the region. A third research team dealt with the identification and quantification of the services of the natural ecosystems in the Tarim area. Finally, a group of social scientists collected information concerning the perceptions of alternative water and land use strategies by stakeholders, including representatives of governmental organisations, scientists, farmers and ordinary people. The findings of all research teams will be accumulated in a so-called Decision Support System (DSS), a software tool designed for policy makers which shall facilitate more sustainable water and land management in the region. This software will show, for example, how, under several climate scenarios, changes in the agricultural production and the installation

of more efficient irrigation technologies would affect future water supply and the natural vegetation. In the same way, the DSS will provide information concerning technical and political measures needed to secure water supply and to preserve the natural ecosystems along the Tarim River. Hence, the DSS is expected to be used by public authorities to design more sustainable water and land management strategies that would lead to an improvement of the environmental conditions in the region. Calculating the costs of such an environmental project is rather straightforward. To decide whether the environmental project is worth these costs, however, one important figure is still missing: the social benefit accruing from the restoration of the natural vegetation along the Tarim River.

6.1.3 Social benefits of more sustainable oasis management

The restoration of the natural vegetation along the Tarim River will have immediate effects on the wellbeing of local people since their living conditions are directly impaired by water shortage and all kinds of environmental problems like dust, sandstorms, soil erosion and soil salinization. Even more than the present generation, future generations are expected to be the main beneficiaries of more sustainable oasis management because the latter would mediate the local impacts of climate change. In addition to that, benefits may also accrue to people living in other parts of China. This is due to the non-use values of the prospective environmental restoration project. Both local people and people living in outside areas may feel great relief from knowing that a complete desertification of the Tarim area will be prevented and that water supply security will enhance the living conditions of future generations. In the same way, both groups of stakeholders might gain satisfaction from simply knowing of the existence of rare plant and animal species in the Tarim area. Furthermore, people from other parts of China may wish to preserve the option of visiting the Tarim area one day and of enjoying a pleasant climate, the beauty of poplars and other goods and services provided by the riparian ecosystems. Finally, altruism towards their fellow citizens in Northwest China may be another reason why benefits also accrue to people who are not directly affected by water shortage and the destruction of the riparian ecosystems along the Tarim River. Taken together, the total economic value of the Tarim project is likely to encompass both use and non-use values. Since non-use values are likely to contribute considerably to the TEV of this environmental project, stated preference methods are most suitable for a comprehensive assessment of the overall social benefit accruing from the restoration of the natural vegetation in the Tarim area. Environmental valuation methods which are based on utilisation behaviour like the travel cost method or hedonic pricing, in contrast, may substantially underestimate the project's actual social benefit (cf. Ahlheim et al., 2013b) Hence, the researchers involved in the socio-economic SuMaRiO-subproject decided to assess the social value of the environmental project by means of a CVM study.

As explained in chapter 2, CVM surveys ask randomly selected respondents to directly state their WTP for a specific environmental project. Given that the sample is representative for all households affected by the environmental project, the social benefit can be calculated by multiplying the sample's average WTP by the total number of households affected. Due to this

aggregation procedure, the monetary value derived from a CVM survey depends both on the magnitude of the sample's average WTP and also on the number of households which fall into the definition of 'being affected' by a particular environmental improvement. It is to be noted that in spite of the immense population growth in the last decades, the Tarim Basin is still relatively scarcely populated. It is inhabited by approximately 10 million people, corresponding to merely 0.07% of China's population. Therefore, even if the direct benefit accruing from the restoration of the natural vegetation was adequately captured by the results of a representative CVM survey of the local population, the environmental project may not pass the cost-benefit test. Other public projects to be implemented in less remote areas of China would most probably outperform the Tarim project. However, the overall social benefit of the preservation of the natural vegetation in the Tarim area is expected to increase considerably when broadening the definition of the population affected by the prospective environmental improvement. As argued in the previous paragraph, people living in other parts of China may also welcome this environmental project. If the non-use value of the environmental improvement indeed increased their wellbeing, it can also be expected that these people would be willing to contribute financially to environmental restoration in the Tarim Basin. If this was the case, not only local people should be surveyed; ideally, WTP would be assessed by means of a nation-wide survey. Nevertheless, before implementing such a large-scale and thus costly survey, the hypothesis concerning the 'long-distance value' of more sustainable oasis management in the Tarim Basin needs to be tested.

The CVM survey carried out in the context of the SuMaRiO subproject 5.4.1 served as an empirical test of the existence of nation-wide non-use values, i.e. whether or not the project's benefits are also perceived by people living far away from the project site. This exemplary CVM survey was carried out in China's capital, the city of Beijing. Some general results of this survey have already been published (Ahlheim et al., 2013b, Rumbaur et al., 2015, Ahlheim et al., 2015b, Ahlheim et al., 2015c). Besides the empirical objective of testing the existence of a long-distance benefit accruing from the implementation of more sustainable water and land use strategies in the Tarim area, several methodological objectives were in the focus of this environmental valuation study. Most importantly, the involved scientists aimed to improve the validity and reliability of WTP estimates in general and of values assessed in CVM surveys conducted in Chinese megacities in particular. Among other things, the effect of monetary incentives on the participation rate and on respondents' motivation to answer interview questions was tested. For this purpose, different variants of the questionnaire had been developed and used in different split samples. In addition to these field experiments, the questionnaire contained several psychometric inventories relating to certain attitudes and personality traits, which had been identified as potentially relevant for WTP statements in general and for the answers of Chinese citizens in particular. Most of these methodological research questions are unrelated to the overall objective of this dissertation and will therefore not be discussed in further detail.

6.2 A CVM survey in Beijing

6.2.1 Preparation of the CVM survey

The preparation of the CVM survey started at the beginning of the year 2012. To get more insights into the social, economic and environmental situation in the Tarim Basin, the preparation phase started with a number of expert interviews. A field trip to the Tarim River was part of this preparation phase, too. During this trip in-depth interviews with local scientists and citizens from Korla, an oasis city located at the middle reaches of the Tarim River, were carried out. Furthermore, to get a clearer picture of ordinary people's previous knowledge and impressions about water shortage and environmental problems in the Tarim Basin, a considerable number of semi-standardised interviews were conducted with randomly selected citizens in Beijing. Based on the inputs of scientists and the contributions by common people from Xinjiang and Beijing, a first version of the CVM questionnaire was developed. This questionnaire was then translated into Chinese, pretested in several series of face-to-face interviews, discussed during four citizen expert group meetings and continuously revised.

During the in-depth interviews and the first pretests in Beijing it became obvious that the majority of respondents had relatively little previous knowledge about the Tarim Basin. Most interviewees said that they had already heard of the Tarim River but had never been there and only a few were aware of the pervasive water shortage, desertification and other environmental issues in the Tarim Basin. Hence, prior to presenting the environmental restoration project to be valued, relatively detailed information about the natural vegetation and the impact of water shortage on the environmental conditions in the Tarim area had to be provided to the respondents. Subsequent to a comprehensive description of the status quo situation, the interviewer read out a specific project scenario to the respondents. Initially, several concrete measures of the 'Tarim Environmental Preservation Plan' (TEPP), a hypothetical government program to restore and preserve the natural vegetation along the Tarim River, were presented. These measures encompassed, for example, the introduction of water-saving agricultural methods with efficient irrigation methods, reforestation of the riparian forests, enhancement of the water distribution infrastructure as well as measures to strengthen the local water and land use monitoring system. However, many respondents perceived these rather technical aspects as too complex. When asked whether they were willing to contribute financially to the TEPP, several respondents said that they were not able to judge the effectiveness and usefulness of such a complex environmental project. For this reason, the final questionnaire encompassed a detailed description of the status quo situation and only a brief depiction of the environmental project to be valued. The interviewers handed out visual material, including maps and photographs, so that the respondents had vivid impressions of the state of the environment in the Tarim Basin before being confronted with the project and payment scenario.

The formulation of the payment scenario posed similar issues. Respondents were told that existing public funds were insufficient to cover the costs related to the realisation of the TEPP.

Therefore, the central government had to collect additional money from households all over China. Initially, a payment card was used to elicit people's WTP. Respondents had to select the maximum amount their household would accept to contribute monthly to a particular fund, established to finance the TEPP, from this payment card. To avoid that respondents understated or overstated their WTP for strategic reasons, the payment rule was formulated in a way that respondents had an incentive to give an honest answer.[15] However, having designed the payment scenario in accordance with the state-of-the-art CVM guidelines came at the cost of lengthening the interview. The interviewers reported that many respondents became impatient when listening to the payment scenario. A considerable number of participants admitted that they had difficulty in performing the valuation task and asked the interviewer to explain again what they were supposed to do. In view of these issues, the research team finally decided to abandon the payment card format and employed a variant of the dichotomous choice format instead. As highlighted in section 2.3.1, a main advantage of DC over alternative elicitation formats is that most respondents perceive the payment question as simple and easy to answer. However, the main argument against the DC format is that many respondents may wish to express their favourable attitude towards the environmental project in question even though their actual WTP is lower than the amount of money they are asked to pay. Thus, because of the potentially large number of polite 'yes' responses, average WTP may be biased upwardly. To tackle this issue, the so-called trichotomous choice, initially developed and recommended by Loomis et al. (1999), was employed.

In the final version of the questionnaire (cf. appendix 8.2), respondents were told that the TEPP would have to be financed through a surcharge on the value-added-tax. This tax increase would lead to higher monthly expenditures for every Chinese household. Respondents were asked whether they supported the implementation of the TEPP although this project would increase their monthly expenditures by an average amount corresponding to a randomly assigned bid of 10, 25, 50, 75, 100 or 200 RMB[16]. The bid design was based on the results of a 200 pretest survey. During this pilot study 10 RMB was rejected by approximately 20% of the respondents and therefore chosen as the lower bound of the range of bids. 80% of the respondents rejected to pay 200 RMB so that, following Kanninen's (1995) rule-of-thumb (cf. section 2.3.1), this amount was defined as the highest bid. After having been asked the referendum-style elicitation question, the respondents could choose from three answer options, including a 'no, but'-option reflecting a person's general support of the environmental project but a rejection of the bid. In addition to allowing the respondents to show their favourable attitudes towards the environmental project even though their WTP is lower than the proposed bid, the trichotomous choice format has advantages over the standard DC format because it enables an analyst to identify zero WTP statements. It is expected that a respondent whose WTP is zero ticks the unconditional

[15] The Becker-DeGroot-Marschak-method, an incentive-compatible payment mechanism which is often used in experimental economics, was used to measure WTP.

[16] In September 2013 the RMB-Euro exchange rate was 0.123. The lowest bid thus amounts to €1.23 and the highest bid to €24.60, corresponding to approximately 0.1% and 2.4% of an average household's monthly income.

'no'-option (i.e. 'No, my household does not tolerate any increase of its monthly expenditures in order to get the TEPP realised' in the survey considered here). The latter aspect is particularly useful in view of analysing the supposedly zero WTP of respondents with a strong inhibition against spending money. Table 6-1 displays the final version of the project scenario, the payment scenario and the trichotomous choice payment question.

Table 6-1: Project and payment scenario

Project scenario

Scientists have developed a program with the overarching goal to improve the living conditions in the area along the Tarim River for man and nature. This program is called the Tarim Environmental Preservation Plan (TEPP) and implies a science-based water management that ensures that more and more water arrives in the lower reaches of the Tarim River, so that the riparian forests and grasslands can recover there. Once the river and its natural environment will have fully recovered, the area will be less exposed to sandstorms and dust; typical animals and plants will survive; also, the living conditions of future generations will improve.

Payment scenario

In order to get the Tarim Environmental Preservation Plan financed, Central Government needs to transfer more money to the Tarim area. In order to finance these transfer payments government would have to increase taxes if TEPP was realized. This would lead to rising monthly expenditures for households. Economists estimate that the proposed program would increase an average Beijing household's monthly expenditures by approximately [BID] RMB.

We would like to find out whether Beijing citizens support the implementation of the Tarim Environmental Preservation Plan although it implies an increase in their monthly expenditures.

Payment question Considering that your monthly household expenditures would increase by approximately [BID] RMB through the program would you personally be willing to support it?	○ Yes ○ No, but if the amount was lower, my household would support the TEPP ○ No, my household does not tolerate any increase of its monthly expenditures in order to get the TEPP realized

Apart from a number of challenges which had to be solved when designing the questionnaire, finding an adequate sampling strategy was particularly difficult. It turned out at the very beginning of the field work that conducting interviews with randomly selected households would be hardly feasible in Beijing. According to experienced social scientists, the access to official household registration lists is exclusively reserved to government representatives in China. Hence, even Chinese scholars and commercial survey institutes usually have to work without such lists when conducting surveys. In addition to that, Beijing residents are extremely reluctant to open their doors to strangers so that the conduct of interviews at people's homes appeared to be unpromising. Subsequent to a very limited number of household interviews, mainly with friends of the Chinese project partners and research assistants, the research team switched to an intercept survey mode. The representativeness of the intercept survey was ensured by using a

quota sampling approach, thereby controlling for gender, age and education. Information concerning these three demographic characteristics was obtained from the Beijing Statistical Yearbook (Beijing Municipal Bureau of Statistics, 2012, 2013). Naturally, changing the sampling strategy had consequences for the course of the interview. Most obviously, the questionnaire had to be shortened since the usual length of a CVM household interview, 40 to 60 minutes, exceeded the patience of most respondents. Several elements of the questionnaire, including the shortening of the project scenario and the simplification of the payment question, partly resulted from the new sampling mode. In addition to that, only a few cognitively demanding and therefore time-intensive attitudinal questions could be asked during an interview.

Moreover, the definition of the population to be surveyed had to be reconsidered. The municipality of Beijing has, according to the latest official estimate in 2011, a population of 20 million (c.f. Beijing Municipal Bureau of Statistics, 2013). Beijing has a land area of 16,411 km^2 and is divided into 16 districts and counties. Most of these administrative units still consist of mainly rural areas with a low population density. Conducting intercept interviews in scarcely populated rural areas and asking contingent valuation questions to rural people, who mostly have low incomes at their disposal and relatively low levels of education, turned out to be difficult. In addition to that, the municipality of Beijing was simply too large for conducting a representative intercept survey, given the capacities, time and the budget of the research team. It was therefore decided to focus on urban Beijing which encompasses the six districts with the highest level of urbanisation, namely Dongcheng, Xicheng, Chaoyang, Fengtai, Shijinshan and Haidian. Accordingly, the area that had to be covered reduced to 1,368 km^2 only. However, even though this area makes up 8.3% of Beijing's total land only, the number of people living in this region is still relatively high as compared to the total population of the municipality. The registered population of urban Beijing is 8 million people (or 2.8 million registered households). The official number of permanent residents, including temporary residents, amounts to 12 million (Beijing Municipal Bureau of Statistics, 2013: 56). However, due to the high influx of migrant workers into the capital the actual number of people living in the urban districts of Beijing is likely to be even higher.

As displayed in Figure 6-1, participatory approaches were employed over the entire course of the CVM study. A group of twelve Beijing residents, who had been recruited during the first pretests, was gathered several times during the course of the research agenda. These citizen experts, mainly students and young professionals, assisted the Chinese-German research team by improving the questionnaire and interpreting the preliminary and final results. The input of the CEG was particularly fruitful for the revision of the different text passages read out during the interviews, such as the description of the ecosystems along the Tarim River. Furthermore, the CEG members judged the comprehensibility and appropriateness of several attitudinal questions and made suggestions about how to adapt them to the particular cultural and social context of the study. Finally, subsequent to a total of 700 pretest interviews, four CEGs, a careful analysis of the preliminary results and a continued revision of the questionnaire, the main survey was implemented at the end of August 2013.

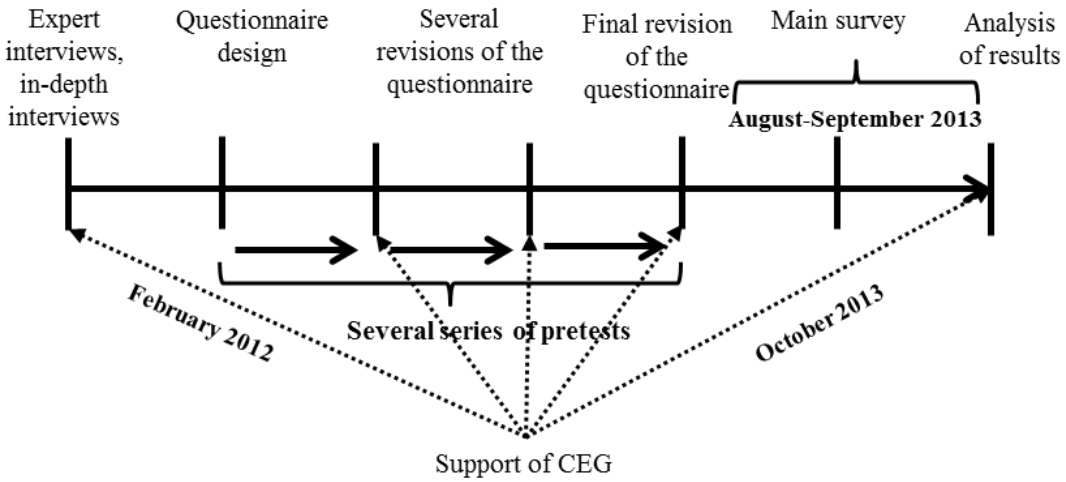

Figure 6-1: Involvement of Citizen Expert Groups during the CVM study in Beijing

6.2.2 Measuring money attitudes

As argued in the previous chapter, attitudes towards spending money are likely to affect WTP statements. To test the three hypothesises and to answer the research questions presented in section 5.4.3 respondents' attitudes towards spending money were assessed in the CVM survey conducted in urban Beijing. This section introduces the set of questions used to measure Beijing residents' money attitudes.

The retention-subscale of Furnham's (1984) Money Believes and Behaviour Scale, introduced in section 4.2.2 and 5.1.2, provides a suitable tool for measuring a respondent's money spending disposition or, more precisely, his or her inhibition against spending money in general. This inventory encompasses several items which describe the attitudes and habits of misers and was therefore adapted to account for Beijing residents' level of stinginess and to test the effect of the derived variable on stated WTP.

The set of questions used in the present study is mainly based on Furnham's (1984) money-retention-inventory, both in its initial form and also as reported in a later validation study by Wilhelm et al. (1993). However, several modifications had to be made in order to adapt the scale to the social and cultural context of the present CVM study. Participatory approaches and pretests contributed to the development a suitable inventory to measure the money attitudes of the participants of the intercept survey on sustainable oasis management. In summer 2012 the original set of items developed by Furnham (1984), translated into Mandarin Chinese, was integrated into the preliminary questionnaire and tested during a small round of pretests (25 interviews). The interviewers read out six items and asked the respondents to indicate how well the individual items described their everyday behaviour with money on a five-point Likert scale reaching from 'completely wrong' to 'completely true' with 'unsure' as midpoint. It is to be noticed that most former studies had employed seven-point disagree-agree scales. The reason for deviating from this standard approach was that a five-point wrong-true scale was also employed for other debriefing and follow-up questions contained in the CVM questionnaire. Hence, sticking to a tried

and tested response format was preferred to introducing a new answer scale. No major problems, like negative reactions to these questions or monotonic answering were encountered during the pretests. The pretest results were subsequently discussed with the members of the CEG gathered in August 2012. During this CEG meeting the citizen experts learnt more about the psychological concept of money attitudes in general and money retention in particular. After some open questions (e.g. *How do you personally feel about money? How do most Chinese people feel about money?*) the participants were introduced to the Chinese translation of the retention scale that had been used during the pretests. They were asked to judge the scale's comprehensibility. Furthermore, in order to account for possible taboo topics, the CEG members were asked whether the inventory contained any items that may irritate or upset Chinese respondents. The CEG criticised the translation of several items, suggested to change the midpoint of the Likert scale from 'unsure' to 'partly wrong, partly true' and emphasised that one of the original items, namely 'I often buy things that I don't need or want because they are in sale' does not make much sense because sales are very unusual in China. Based on these advises, the translation of the items, the Likert scale and the contents of the retention scale were adapted. The unsuitable item was dropped and replaced by the statement 'Money should be saved not spent' (Klontz et al., 2011). The adapted money attitude inventory was anew tested during 100 pretest interviews in spring 2013.

Another CEG meeting took place in April 2013 to discuss the results of the previously completed round of pretests. During this meeting the citizen experts backed my supposition that respondents' money attitudes mattered for their answers to the payment question asked during the CVM interview. They were also presented a number of unexpected results, like the surprisingly large number of pretest participants (45%) who had approved the statement 'Even when I have sufficient money I often feel guilty about spending money on necessities like clothes etc.' The citizen experts found these results plausible because, according to them, clothes did not count as 'necessities' in China. The complement 'like clothes etc.' was therefore deleted. Regarding the item 'I feel compelled to argue or bargain about the cost of almost everything I buy' one participant commented that bargaining was not an expression of miserliness in China but a very common shopping strategy. Nevertheless, this item was maintained, especially because of its strong correlation with the remaining statements. Subsequent to this second CEG meeting on money attitudes, no major changes were made anymore. The final set of modified statements and the original items are displayed in Table 6-2.

Table 6-2: Modified money retention scale

Items used in the present study	Original wording and source of items
5-point Likert scale 'completely wrong' (1), 'predominantly wrong' (2), 'partly wrong, partly true' (3), 'predominantly true' (4), 'completely true' (5)	7-point Likert scale 'disagree' (1) to 'agree' (7)
I often have difficulty **to bring myself to spend** money regardless of the amount.	I often have difficulty in making decisions about spending money regardless of the amount (Furnham, 1984)
In making any purchase, for any purpose, **spending money is painful for me.**	In making any purchase, for any purpose, my first consideration is the cost (Furnham, 1984)
I often say 'I can't afford it' whether I can or not. **[not modified]**	I often say 'I can't afford it' whether I can or not (Furnham, 1984, Wilhelm et al., 1993)
Even when I have **enough** money I often feel guilty if I spend money on necessities**.**	Even when I have sufficient money I often feel guilty about spending money on necessities like clothes etc. (Furnham, 1984)
I feel compelled to argue or bargain about the cost of almost everything I buy. **[not modified]**	I feel compelled to argue or bargain about the cost of almost everything I buy (Furnham, 1984, Wilhelm et al., 1993)
Money should be saved not spent. **[added]**	Money should be saved not spent (Klontz et al., 2011)

For the purpose of econometric analysis, a variable referring to respondents' attitudes towards spending money has been constructed based on their answers to the six money retention items. In line with previous studies on money attitudes, this variable has been built by summing up the item-specific scores and dividing the result by the total number of items. Since respondents had to indicate their level of agreement with the six statements on a five-point Likert scale, the derived interval variable can take values from one to five; the higher the score, the greater is a subject's unwillingness to spend money in principle. Naturally, before constructing this variable, the validity and reliability of the psychometric measure had been carefully tested (see section 6.4.1).

A potentially weak point of the modified money attitude inventory is that none of the six items pointing to a single attitude is reversed. As a consequence, individuals might answer monotonically, for example by always choosing the same interval on the Likert scale, rather than thinking deeply each time they are confronted with a new statement. To tackle this issue, three statements concerning a person's habits when spending money on others were mixed among the money retention items ('I often spend money, even foolishly, on others but grudgingly on myself' (Furnham, 1984); 'I am very generous with people I love' (Furnham et al., 2012); 'I get a

good feeling from contributing money to all kinds of good causes' (adapted from Nunes and Schokkaert, 2003)).

6.2.3 Implementation of the CVM survey

During the main survey approximately 2,500 residents living in the urban areas of Beijing had to be interviewed. The data collection started at the end of August 2013 and was completed at the end of September 2013. 52 sociology students from the Minzu University of China worked as interviewers during these six weeks. All of them had been trained in interview techniques for standardised face-to-face interviews prior to the fieldwork. Many students had already been involved in the different series of pretests and were therefore quite experienced in conducting CVM interviews. The students worked in groups of three to six interviewers. On each interview day these groups were assigned to different locations in different parts of the city, so that residents from all six urban districts had the chance to enter the sample. The interviewers were free to choose suitable places to conduct interviews (public parks, residential communities, cafés, etc.) in the surrounding of the locations they had been assigned to. They stopped people randomly but had to make sure that the subject who agreed to participate in the survey also fulfilled the required quota, that this person was living in one of the six urban districts and that he or she had been living in Beijing for at least five years. The latter criterion was employed to avoid that tourists, migrant workers and other people who were not permanently living in Beijing entered the sample. To ensure the data quality, some older master students supervised the groups of interviewers. In addition to that, all interviewers were equipped with MP3 players and had to record their interviews.

All interviews were based on the standardised CVM questionnaire that is displayed in the appendix 8.2. In line with this questionnaire, an interview consisted of the following parts: Firstly some basic demographic characteristics like a respondent's age, ethnicity and marital status were assessed. Afterwards the environmental site was introduced to the respondents. Several questions regarding a respondent's background knowledge and experience with the Tarim Basin were asked. In the subsequent part, respondents obtained detailed information about the endangered ecosystems in the Tarim area. Afterwards, the environmental project and the related payment mechanism were presented, followed by the trichotomous-choice-style elicitation question. Subsequently, the plausibility of the WTP statement was assessed by means of two sets of debriefing questions. The first set of questions contained protest-statements which were adapted from examples in environmental valuation textbooks such as Bateman et al. (2002) and from former CVM surveys conducted in China (e.g. Ahlheim et al., 2015a). The second inventory was a modified variant of a procedure proposed by Baker et al. (2012) to identify the factors that respondents had taken into account when making their WTP statement; among other things, respondents were asked whether or not they had considered their budget, the opportunity costs of their choice as well as several non-use benefits accruing from the environmental project before answering the referendum questions. Afterwards, the respondents had to answer questions regarding the economic situation of their household (household size, disposable household income,

etc.) and their saving habits. The questionnaire also contained different inventories borrowed from psychology, including the modified version of Furnham's (1984) money retention scale which has been presented in the previous section. In addition to that, the interviewers had to fill in questions concerning the interview process, like the number of rejections before finding a respondent, duration of the interview, the interview spot and questions concerning a respondent's behaviour during the interview.

At the end of September 2013, a total of 2,472 interviews were completed. 34 interviews had to be dropped because of missing information on age, home districts or because the respondents did not fulfil the selection criteria of having been living in Beijing for at least five years. For the remaining 2,438 valid observations the quota on gender, age and education are well fulfilled. Furthermore, the respondents' home districts represent approximately proportionally the population of the six urban districts at the time of the survey. Hence, although the common CVM guidelines, which prescribe random sampling and household interviews, could not be followed, the sample closely reflects several key characteristics of Beijing's urban population.

6.3 General results of the CVM survey

6.3.1 Descriptive statistics

As already mentioned, the overall survey encompassed different variants of the questionnaire. Only two of these variants contained the money attitude inventory presented in section 6.2.2. The following illustrations are therefore limited to only two splits of the overall sample, corresponding to 1,193 interviews. Furthermore, several interviews had to be dropped because of missing answers to relevant questions. The most frequently missing variables included household income (14 missing answers), answers to debriefing questions (51 missing answers) as well as answers to several items of the money attitude inventory (80 missing answer). After having discarded 123 interviews in total, the final sample size reduced to 1,070 observations.

The interview process

Regarding the sometimes criticised intercept interview technique which had to be employed in the present survey, it appears to be of particular interest to investigate the general behaviour of the interviewees in the first place. Critics may argue that a person's motivation to take part in a CVM interview and to carefully answer more than 50 questions would be rather low when stopped suddenly and without a warning on the streets of a Chinese megacity. To address such concerns, a number of questions regarding the response rate, the duration of an interview and respondents' behaviour during the interview, which were filled in by the interviewers subsequent to each interview, shall be analysed briefly.

Based on the information reported by the interviewers, 2.6 individuals had to be approached on average to find a person who was willing to participate in the interview. This corresponds to a quite satisfactory response rate of approximately 38.5%. An interview took 23 minutes on average. This figure may appear low when comparing it to the length of a standard CVM household

interview, but it is a considerable amount of time in the case of an interview conducted in public. To get some insights to how the time-intensive CVM interview was perceived, the interviewers had to rate the respondents' motivation and reactions to certain questions on a five-point Likert scale. The average ratings for several relevant items are displayed in Table 6-3. In general, the interviewers were very positive about the respondents' attentiveness, seriousness and motivation during the interview. Hastiness was not reported as a frequent problem either. All in all, these results cast a positive light on the interview process.

Table 6-3: Respondents' behaviour during the interview

Statement	**Mean[1]** **(standard deviation)**
The respondent listened carefully to the information on the Tarim area.	4.251 (0.725)
The respondent took the interview very seriously.	4.225 (0.757)
The respondent was highly motivated during the interview.	3.965 (0.887)
The respondent wanted to end the interview as fast as possible.	2.088 (1.039)

[1] Average score on a 5-point Likert scale: 'completely wrong' (1), 'predominantly wrong' (2), 'partly wrong, partly true' (3), 'predominantly true' (4), 'completely true' (5)

Characteristics of the sample population

Table 6-4 shows the official characteristics of Beijing's urban population and the sample characteristics. The sample resembles the official data in terms of most of these characteristics. 51.9% of the respondents in the sample are male, they are on average 39 years old and 41.0% have a university degree (college graduate or higher). In terms of these three variables, the characteristics of the general population have been well reproduced. The size of the respondents' households exceeds the official average household size by approximately 0.3 household members. Most respondents are Han Chinese, but the share of ethnic minorities is higher than officially reported. It is to be noted that all interviewers were recruited from the Minzu University, which is designated for ethnic minorities in China and that one third of them were ethnic minorities. People with non-Han background may have felt more concerned when asked whether they would like to participate in a survey on environmental problems in a region which is the home of several ethnic minorities conducted by students of the Minzu University. Hence, the overrepresentation of ethnic minorities is likely to be a result of both the survey's topic and the ethnic background of the interviewers. Comparing the sample's characteristics with the official figures, the most peculiar difference is disposable household income. Based on the data gathered in autumn 2013, the average monthly disposable household income amounts to 8,871 RMB. This estimate is significantly higher than the official number of 7,640 RMB, which was measured in the 2011

census. However, this at first glance substantial difference may simply reflect a general income increase from 2011 to 2013. When observing the official numbers reported in the Statistical Yearbook, an increase of 16% in that period appears plausible.[17]

Table 6-4: Characteristics of the sample

Variable	**Official data[1]**	**Sample (N=1070)**
	mean	**mean [95% conf. int.]**
Gender (1=male; 0=female)	0.504	0.519 [0.489; 0.549]
Age (in years)	38	39 [38; 40]
Ethnicity (1=Han; 0=minority)	0.959	0.909 [0.892; 0.927]
Education (1=higher; 0=middle or lower)	0.382	0.411 [0.381; 0.440]
Household size (persons)	2.567	2.909 [2.825; 2.993]
Monthly disposable household income (in 1,000 RMB)	7.640	8.871 [8.371; 9.367]

[1] Beijing Municipal Bureau of Statistics (2013)

Histograms for the categorical variables referring to the home provinces and the occupational situation of the respondents are displayed in Figure 6-2. Merely 36.0% of the respondents indicated Beijing as their home province. This result comes very close to the official share of non-native residents published the Statistical Yearbook, which is 36.8%. These figures reflect the high influx of people from other parts of the country into the capital. The relatively high number of respondents from the neighbouring province Hebei is also plausible. Furthermore, many respondents come from Henan and Shandong which are, in terms of residents, China's second and third most populated provinces. Concerning different occupational situations, most respondents are employees (38.2%), followed by the groups of self-employed (25.4%) and retired people (15.1%). Taken as a whole, the sample is diverse and, in spite of some minor dissimilarity in terms of ethnic groups and household size, representative for the general population.

The survey results also confirm one of the observations made during the pretests, namely that Beijing residents are relatively unacquainted with the Tarim area. Very few respondents (3.9%) had ever been to the Tarim area. However, most people (69.5%) reported that they had already heard about the Tarim River before participating in the survey. Still, a considerable share of respondents was completely ignorant of the project site (26.8%). Given the little experience Beijing residents have with the Tarim area, one may doubt that they would be willing to financially support an environmental project carried out in that region.

[17] Just for comparison: family gross income increased by 11.3% and annual disposable per capita income by 13.2% from 2010 to 2011 (Beijing Municipal Bureau of Statistics, 2013).

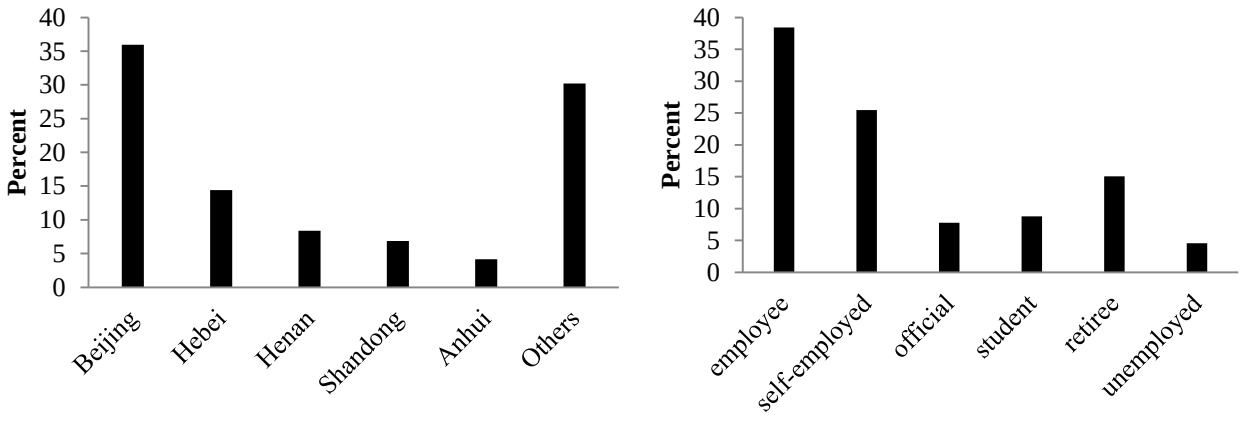

Figure 6-2: Home provinces and occupations of the respondents

Answers to the elicitation question and debriefing questions

As explained before, WTP for the so-called 'Tarim Environmental Preservation Plan' was assessed by means of a referendum question. Respondents had to choose their preferred out of three answer options. They were randomly assigned one out of six bids, ranging from 10 to 200 RMB. Regarding the construct validity of the CVM value estimate, unconditional agreement (i.e. the share of 'yes' answers) should decrease when the bid is increased. Furthermore, it is expected that the share of 'no, but' answers, i.e. the share of respondents with a WTP greater than zero but lower than the assigned bid, increases with the bid level. Finally, the effect of the bid on the probability that a respondent chooses the third answer option is not quite clear. In the present study the third answer option indicates a zero WTP ('No, my household does not tolerate any increase of its monthly expenditures in order to get the TEPP realised'). It is expected that people who derive no utility from the TEPP, those who cannot afford to give up any money for this environmental project and people who reject the idea of paying for it for ethical reasons, fairness aspects or because of some psychological motive like miserliness choose this unconditional no-option. On the one hand, it is plausible that the share of zero WTP statements remains constant over different bid amounts because the number of respondents who would not benefit, who are too poor or too stingy to pay can be expected to be independent of the bid. On the other hand, higher bids may increase the likelihood that respondents choose the no-option, for example because they perceive the payment as increasingly unfair.

Merely two out of the 1,070 respondents did not answer the elicitation question. The responses of the remaining 1,068 respondents are displayed in Figure 6-3. Conforming to prior expectations, the fraction of 'yes' responses decreases for higher bids. The share of respondents who chose the second answer option ('no, but') also behaves as expected. The higher the bid was, the more respondents expressed a conditional agreement. Finally, the share of zero WTP constantly increases up to the bid of 150 RMB but slightly decreases from 150 to 200 RMB. It is to be noted, however, that the relative number of zero WTP statements is not significantly higher for 150 RMB than for 200 RMB (32.4% and 38.2% respectively). As already noted, the general increase

of ‘no’ responses with the randomly assigned bid amount may result from increasingly negative attitudes towards the payment scenario. From this perspective, it appears interesting to gain more insights into the factors influencing the probability of stating ‘no’ rather than choosing one of the two answer options that reveal a positive WTP. The econometric analysis presented in section 6.4.3 shows that, unlike most socio-demographic respondent characteristics, higher levels of money retention heavily influence the likelihood of choosing the ‘no’-options, i.e. stating a WTP of zero.

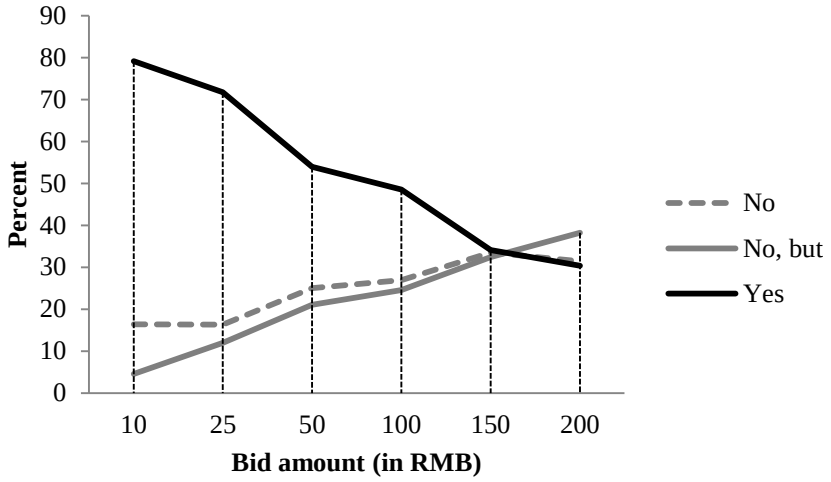

Figure 6-3: Relative distribution of responses to the referendum question

Due to the referendum format of the elicitation question, the sample’s average WTP cannot be directly computed at this stage. Nevertheless, the descriptive analyses indicate that the WTP of most respondents is substantially higher than zero. A vast majority agreed to pay 10 RMB for the realisation of the TEPP and almost one third (30.0%) of the respondents who were assigned to the highest bid stated that they would tolerate a 200 RMB increase of their monthly expenditures. According to these results, an average Beijing resident is, in spite of his or her previous unawareness of the environmental problems in Northwest China, willing to make a surprisingly high financial contribution to the restoration and preservation of the natural vegetation along the Tarim River.

To better understand the motivation underlying the answers to the elicitation question, the respondents were asked a number of debriefing questions (cf. matrix question 20 of the questionnaire displayed in the appendix, 8.2). Their reactions to three protest statements are presented in Table 6-5. 75.0% of the respondents said that the central government should bear the entire costs arising from the realisation of the TEPP. 73.2% objected the payment vehicle and 67.4% disliked that all households, including the poor, would face increased monthly expenditures if the TEPP was implemented. Regarding the generally strong objection of the payment scenario it is even more surprising that so many respondents still voted in favour of the environmental project and the related payment. This at first glance counterintuitive result was also discussed during the final CEG meeting in October 2013. In contrast to the German researchers, the citizen experts were little astonished about the widespread protest against the payment scenario. According to

them, it was simply common sense among Beijing residents that taxes were already too high, that the central government was wasting money and that poor households should be exempted from any additional charge. However, sharing this point of view was not necessarily a reason for opposing the TEPP, according to the citizen experts. Hence, the overall high levels of protest do not immediately threaten the validity of the WTP estimate. Furthermore, as section 6.4.4 will show, protest against the payment scenario is related to respondents' money attitudes. The present study unambiguously illustrates that stingy respondents are more likely to protest against the payment scenario than respondents who behave less miserly with their financial resources. Accordingly, rather than being the outcome of a poorly designed payment scenario, widespread protest can be explained by some more general attitudes towards different aspects of life.

Table 6-5: Agreement with protest statements and considerations of non-use values

Statement	**Agreement**
Poor households should not have to pay for the TEPP.	67.4%
Not households but central government alone should pay for the TEPP.	75.0%
Taxes are already so high that increasing taxes is not a good way to finance the program.	73.2%
Did you consider…	
… the TEPP's positive effects for plants and animals? (XV)	53.0%
… the TEPP's positive effects for future generations? (BV)	62.0%
… the TEPP's positive effects on the living conditions of local people? (AV)	44.0%
… your chances of visiting the Tarim area some day in the future? (OV)	40.4%

To gain more insights concerning the motivations underlying individual reactions to the WTP question, the second set of debriefing questions included in the questionnaire shall be explored as well (cf. matrix question 21, appendix 8.2). Since an overwhelming majority of Beijing residents are only indirectly affected by the environmental project in question, positive WTP statements can, according to economic theory, be interpreted as the benefit an individual expects to gain from the non-use aspects of the TEPP. To test the theory, respondents were asked whether they had indeed considered the existence value, the bequest value, the altruistic value and the option value of the project before answering the referendum question. The figures presented in Table 6-5 show that the bequest value is the most frequently considered aspect of the environmental project in question, followed by the existence value of plants and animals. A relatively smaller share of respondents said that they had considered the project's altruistic value and its option value. The first two results come as little surprise given that the TEPP would mainly enhance the living conditions of future generations and because of the detailed description of the deterioration of the natural vegetation along the Tarim River which had been presented to the respondents before asking the payment question. Little importance attached to preserving the option of visiting the environmental site in the future is plausible as well, given the relatively low popularity of southern Xinjiang as tourist destination among Beijing citizens (as reported above, merely 3.9%

of the respondents had ever been there). The respondents' comparatively little concern for local people, however, requires explanation. A pretty bold but possibly plausible assertion would be that this result reflects the resentments of Han Chinese people towards the inhabitants of the Tarim Basin, who are mainly Uighurs, an ethnic minority which is nowadays known for ethnic unrest and terror in China. Finally, it is also worth noticing that only 21.4% of the respondents admitted that they had considered none of the four kinds of non-use values. These results reveal that most respondents perceived the 'long-distance benefits' of the environmental project. It is interesting to note that, unlike protest, the perception of the long-distance benefits hardly varies across respondents that hold different money attitudes. As demonstrated econometrically at a later stage of this chapter, stingy respondents are as likely to account for non-use values as wasteful respondents. The consequences of this indifference with regard to the validity of the WTP stated by stingy respondents will be discussed in section 6.4.4.

6.3.2 Econometric analysis

So far, the investigation of the results of the CVM survey conducted in Beijing has been limited to a descriptive analysis. In order to assess the sample's average WTP and to gain more insight into the factors which explain an average respondent's answer to the referendum question, econometric techniques need to be applied. This section provides some details concerning the basic econometric techniques which CVM researchers commonly use to analyse respondents' answers to dichotomous choice questions. The trichotomous choice format, which has been used in the CVM survey explored in the present chapter, is just a variant of the standard DC format. The econometric techniques presented in this section are also suitable for trichotomous choice data and will be applied to the data gathered in Beijing. The basic model to analyse DC responses was developed by Hanemann (1984). Apart from Hanemann's (1984, 1989) framework, the present section is mainly based on Haab and McConnell's (2002) more recent publication on parametric models for DC questions.

Econometric model for dichotomous choice data

DC questions are typically formulated in a way such as 'Would you vote for a program to permanently increase environmental quality from z^0 to z^1 if it increased your taxes by €t for this year?' (cf. Freeman et al., 2014: 390). A rational individual will agree with such a question if he or she expects to be at least as well off in the prospective situation (the situation where environmental quality has increased from z^0 to z^1 and the individual's income I_h has been reduced by an amount of t) as compared to the initial situation. In other words, a rational respondent will answer 'yes' to a DC question if the project's net utility exceeds his or her utility of the status quo. Haab and McConnell (2002) represent this trade-off by means of two indirect utility functions:

$$v^1(I_h - t_h, z^1, s_h, \varepsilon_h^1) > v^0(I_h, z^0, s_h, \varepsilon_h^0), \tag{6-1}$$

where I_h is the respondent's household income, z^k the state of the environment, s_h a vector of household characteristics and other attributes (household size, age of the respondent, question-

naire variations, etc.) and ε_h^k a component of unobserved preferences.[18] Since the random part of preferences ε_h^k is unknown, researchers can only make a probability statement about an individual's response to the DC question. The probability of a 'yes' response corresponds to the likelihood that the respondent thinks that he or she will be better off when the proposed project is realised, even though he or she has to make the specified payment. Equation 6-2 expresses this probability:

$$\Pr(yes_h) = \Pr[v^1(I_h - t_h, z^1, s_h, \varepsilon_h^1) > v^0(I_h, z^0, s_h, \varepsilon_h^0)]. \tag{6-2}$$

One possibility of estimating equation 6-2 consists of constructing a parametric model. Several assumptions concerning the functional form of the indirect utility function and of the error term have to be made for this purpose. For the sake of simplification, analysts define the indirect utility function as additive separable in its observable and unknown elements, so that the indirect utility function is the sum of all deterministic components of interest (i.e. I_h^k, $z^k$and s_h^k) and the stochastic component (ε_h^k). Based on this specification, the probability statement becomes:

$$\begin{aligned}\Pr(yes_h) &= \Pr[v^1(I_h - t_h, z^1, s_h) + \varepsilon_h^1 > v^0(I_h, z^0, s_h) + \varepsilon_h^0)] \\ &= \Pr[v^1(I_h - t_h, z^1, s_h) - v^0(I_h, z^0, s_h) > \varepsilon_h^0 - \varepsilon_h^1].\end{aligned} \tag{6-3}$$

As displayed by equation 6-3, the probability that the household's utility increases when the project is realised, even though its income is decreased by an amount of t_h, corresponds to the probability that the change in observable utility exceeds the difference in the stochastic components of preferences. But this equation is still too general to be estimated econometrically, so that the notion needs to be further rearranged. The empirically unobservable difference in error terms can be summarised as one single random term, i.e. $\varepsilon \equiv \varepsilon_h^1 - \varepsilon_h^0$ (see Haab and McConnell, 2002: 26). Furthermore, a cumulative density function of the stochastic component of preferences has to be defined. This cumulative density function $F_\varepsilon(.)$ then describes the probability to a 'yes' response (c.f. Hanemann, 1984: 338):

$$\Pr(yes_h) = F_\varepsilon[v^1(I_h - t_h, z^1, s_h) - v^0(I_h, z^0, s_h)] = F_\varepsilon \overline{\Delta v}. \tag{6-4}$$

A simple and common way to estimate equation (6-4) consists of constructing a random utility model with a linear utility function.[19] Doing so, the following statistical model is generated:

$$\overline{\Delta v} = \left(\alpha^1 + \beta(I_h - t_h)\right) - (\alpha^0 + \beta I_h)) = \alpha - \beta t_h, \tag{6-5}$$

with $\alpha = \alpha^1 - \alpha^0$. The vector α consists of parameters embracing the respondent's observable characteristics s_h; β indicates the marginal utility of income. The probability statement then becomes:

[18] Prices are assumed to be constant so that the vector of market prices is omitted.

[19] The linear model employed here suffers from the very strong assumption of constant marginal utility of income across individuals. In addition to this most simple way of estimating the random utility model, alternative functional forms that are more realistic in terms of the underlying assumptions have been suggested; see for example Haab and McConnell (2002), chapter 2 for more details.

$$\Pr(yes_h) = \Pr(\alpha - \beta t_h + \varepsilon_h > 0). \quad (6\text{-}6)$$

Under the assumption that the random error term is independently and identically distributed with mean zero and a variance of 1 ($\varepsilon_h \sim N(0,1)$), the probability of answering 'yes' can be represented by the following probit model (Haab and McConnell, 2002: 27):

$$\Pr(yes_h) = \Phi(\frac{\alpha}{\sigma} - \frac{\beta}{\sigma} t_h), \quad (6\text{-}7)$$

where Φ is the standard normal cumulative density. Alternatively, a logistically distributed error term provides a logit model, i.e. (ibid.):

$$\Pr(yes_h) = 1 + \exp(-(\frac{\alpha}{\sigma_L} - \frac{\beta t_h}{\sigma_L}))^{-1}. \quad (6\text{-}8)$$

Maximum likelihood techniques, that are nowadays available in all econometric software packages, provide a convenient possibility of estimating the parameters of probit or logit models. The two estimation approaches typically yield very similar results. The simple linear probit model is, however, the most commonly employed parametric model and provides, as shown by Crooker and Herriges (2004), more robust results in estimating average WTP than alternative econometric models.

The parameters of the probit or logit model provide the basis for estimating the sample's average WTP. A single household's maximum WTP, i.e. the amount of money that makes the household just indifferent between the status quo and the environmental improvement, can be integrated into the random utility model of the probability statement. This yields the following equality (c.f. Haab and McConnell, 2002: 33):

$$\alpha^1 + \beta(I_h - WTP_h) + \varepsilon_h^1 = \alpha^0 + \beta I_h + \varepsilon_h^0. \quad (6\text{-}9)$$

Maintaining the assumptions concerning the error terms ($\varepsilon \equiv \varepsilon_h^1 - \varepsilon_h^0$) and the respondent's observable characteristics ($\alpha = \alpha^1 - \alpha^0$), it follows that

$$WTP_h = \frac{\alpha}{\beta} + \frac{\varepsilon}{\beta}. \quad (6\text{-}10)$$

Assuming a standard normal distribution of the error term ε allows to construct the following measure for mean and median WTP (c.f. Hanemann, 1989: 1058, Haab and McConnell, 2002: 34):

$$E_\varepsilon(WTP_h|\alpha,\beta) = \frac{\alpha}{\beta}. \quad (6\text{-}11)$$

Using maximum likelihood techniques (cf. e.g. Wooldridge, 2010) the relevant parameters can be estimated. In STATA this is done by using the probit or logit command to regress the dichotomous choice variable against the bid. STATA provides a coefficient for the model constant as well as a coefficient capturing the bid amount. The estimates obtained correspond to α and $-\beta$ in equation 6-11. In models without explanatory variables α corresponds to the coefficient associated to the constant term and β is the coefficient that captures the bid amount. Accordingly, aver-

age WTP is equal to the negative ratio of the coefficient of the constant term and the coefficient of the bid variable (cf. Lopez-Feldman, 2012).

In order to observe the factors which determine an average respondent's answer to the DC question, the simple model displayed in equation 6-5 has to be extended by including the vector s_{hj}, capturing a household's j observable characteristics, for example demographic variables (gender, age, ethnicity, etc.), socio-economic variables (financial situation, number of household members, role of the respondent within the household, etc.), psychological variables (attitudes, personality traits, etc.) and questionnaire variations (e.g. treatment dummies). In functional terms:

$$\overline{\Delta v} = \alpha - \beta t_h + \gamma_j s_{hj}. \tag{6-12}$$

The parameter vector γ_j is associated to the explanatory variables captured by s_{hj}. Coefficient estimates and standard errors of the parameter β and of each parameter γ_j are reported by all econometric software packages so that the main challenge remains the interpretation of the results of the econometric model. In logit and probit models the magnitude of the coefficients cannot be directly interpreted. However, the sign and the level of significance of the coefficient estimates provide relevant information. For example, a positive sign of the coefficient estimate $\hat{\gamma}_1$ of a statistical significant characteristic s_{h1} is interpreted as a positive partial effect of that characteristic on the probability of answering 'yes' to the DC question (i.e. WTP); the contrary holds true for a negative sign. Naturally, the sign of the coefficient estimate $\hat{\beta}$ should be negative and statistically significant, since the probability of accepting the assigned bid is expected to decrease for higher bid levels.

In the case of implausible effects or the absence of certain expected effects, the validity of the WTP estimate has to be questioned. As explained in section 2.3.2, CVM practitioners commonly check the plausibility of WTP statements by testing whether certain respondent characteristics, questionnaire variations and the bid have the expected partial effect on the response probability. Furthermore, the identification of the household characteristics that affect the response to the WTP question is useful when an analyst wants to make policy recommendations. If it turns out that an increase in a particular variable, for example a respondent's age, alters the probability of voting in favour of a particular environmental project, researchers conclude that this project would be particularly beneficial for elderly people. Following the same logic, the effect of any other variables of interest, like money attitudes, on WTP can be assessed.

Average WTP and overall determinants

The econometric techniques presented above shall now be applied to the results of the CVM survey conducted in urban Beijing. For this purpose, the responses to the referendum question needed to be recoded into a binary dependent variable. As explained before, unlike in the case of a standard DC format, where respondents can answer either 'yes' or 'no', the questionnaire employed in the present study contained three answer options, namely an unconditional 'yes'

($WTP_h \geq t_h$), a polite 'no, but' ($0 < WTP_h < t_h$), and an unambiguous 'no'-option ($WTP_h = 0$). 'Yes' replies were coded 1 and all other replies were coded 0, regardless of whether the actual answer was 'no, but' or 'no'. For the estimation of the sample's average WTP, the latter two options are treated in the same way because both kinds of responses indicate that a respondent's maximum WTP is lower than the specified bid.

As explained previously, the sample's average WTP can be estimated by a probit model where only the binary response variable and the randomly assigned bid (BID) are included. The results of this basic regression model, as rounded figures, are summarised in Table 6-6. As expected, the coefficient of BID is negative and highly significant. Hence, the likelihood of agreeing with the payment question decreases when the bid is increased. Based on the coefficient estimates of the model constant (CONSTANT) and the bid (BID), the sample's average WTP has been computed. An average Beijing household's maximum WTP amounts to 101.06 RMB per month (€12.50). This amount corresponds to approximately 1.1% of an average household's disposable income. Given that households in Beijing are only indirectly affected by the environmental project in question and in view of the unlimited duration of payment, this value appears to be quite high.

Table 6-6: Probit regression model underlying the average WTP estimate

Dependent variable: WTP1		
Variable	**Coefficient**	**Standard error**
CONSTANT	0.670***	0.066
BID	-0.007***	0.000
Log-Likelihood	-673.055	
Pseudo R^2	0.088	
N	1068	

Notes: ***p≤0.01

As highlighted in section 2.3.2, critics argue that CVM surveys yield upwardly biased estimates because of the hypothetical nature of the payment question. In view of this criticism, the plausibility of the relatively high WTP estimate obtained in the present application should be further verified. For this purpose, the factors which affect a respondent's answer choice shall be determined. It is expected that several demographic characteristics are systematically related to a respondent's WTP. Furthermore, the consideration of the project's non-use values as well as protest towards the payment scenario are likely to impact a respondent's WTP. To account for these potential effects, the basic probit regression model displayed in Table 6-6 is extended by a set of eight explanatory variables. Most of these variables have already been presented in the descriptive part of this analysis (cf. section 6.3.1). Moreover, an overview of all explanatory variables used in the following applications can be found in the appendix, section 8.3.

Table 6-7: Determinants of WTP

Dependent variable: WTP1	**Model 1**	
Variable	**Coefficient**	**Standard error**
CONSTANT	1.081***	0.312
BID	-0.007***	0.001
TREAT	0.186**	0.085
MALE	0.174**	0.083
AGE	0.004	0.003
EDU	0.085**	0.035
INCOME	0.006	0.006
HH_SIZE	0.039	0.031
NONUSE	0.483***	0.120
PROTEST	-0.378***	0.052
Log-Likelihood	-621.448	
Pseudo R^2	0.158	
N	1068	

Notes: **p≤0.05; ***p≤0.01

Conforming to prior expectations, the negative effect of BID on the likelihood of agreeing with the referendum question remains robust in the extended model. TREAT is a treatment dummy which takes a value of 1 for respondents who received a gift of money (i.e. an envelope containing 40 RMB) as an incentive to participate in the interview and 0 for those who were not offered such a gift. The positive and significant effect of this variable is plausible but will not be further explored in the present work (for a discussion of the effects of monetary incentives on respondent behaviour in CVM surveys see e.g. Ahlheim et al., 2013a). Among the socio-demographic characteristics of the respondents, gender (MALE) has a significant effect on the likelihood of answering 'yes' to the referendum question. Men have a higher WTP than women, ceteris paribus on other factors. Furthermore, a respondent's level of education (EDU) has a positive effect on WTP, meaning that people with higher levels of education appreciate the environmental project more than others. The latter effect is plausible as well, given that environmental awareness is likely to be particularly widespread among people with higher education levels. Neither INCOME nor HH_SIZE have a significant impact on WTP. At first glance, the absence of an effect of these two household variables, especially the missing income effect, is disturbing in view of the construct validity of the WTP estimate. While the regression coefficient of INCOME takes the expected sign in the model considered here, the effect is far from being significant. It is to be noted that INCOME has a positive and significant effect in a probit model with BID as the only control variable. However, this effect is mediated as soon as additional control variables, especially AGE and EDU, which are significantly correlated with INCOME, are included into the model. Hence, the missing income effect in the extended probit model is not prima facie evidence of construct invalidity but shows that a respondent's objective financial situation matters less than other factors for his or her WTP. Finally, the two attitudinal variables

NONUSE and PROTEST point to the validity of the survey data. The NONUSE variable takes higher values, the more non-use components of the environmental project a respondent has considered. The positive sign of the corresponding coefficient indicates that WTP increases with the awareness of the project's non-use values. Furthermore, higher scores on the PROTEST variable are negatively related to a respondent's WTP. In other words, respondents who oppose the payment scenario ('government alone should pay (…)' etc.) are less likely to agree with the payment question.

Overall, the relationship between the explanatory variables and the answers to the referendum question (i.e. WTP) are convincing. However, the presumably essential relationship between income and WTP could not be detected in the extended econometric model. In contrast, more subjective variables concerning a respondent's perception of the project's non-use values and attitudes towards the payment scenario are powerful predictors for WTP. Given the missing income effect on the one hand and the plausible impact of the two attitudinal variables on the other, it seems to be very possible that the inclusion of other relevant psychological variables will alter the explanatory power of the econometric model. Specifically, attitudes towards spending money may affect respondents' WTP for the TEPP.

6.4 Analysis of money attitudes

6.4.1 Scale validity and distribution of misers in the sample

In the present study, money spending dispositions have been measured by means of a modified version of Furnham's (1984) money retention scale. To assess the scale's validity and reliability in measuring the construct of interest a number of statistical tests and methods shall be applied to the obtained data. As already mentioned, 80 respondents (6.7%) failed to complete the set of money attitude questions. In most cases, the respondents had broken off the interview before having reached the relevant part of the questionnaire. The reasons for cancelling the interview are unfortunately unknown; however, it does not seem to be the case that respondents dropped out because they disliked the questions concerning their monetary habits. In view of the reasonably low item non-response rate, it is concluded that the money attitude questions were well accepted by the respondents and that their integration into the questionnaire did not disturb the process of the CVM interview. An analysis of 50 randomly selected MP3 records of the actual interviews further sustained this impression. The majority of respondents took the six money attitude items seriously, took reasonable time to think about their answers and did not seem to be annoyed or intimidated by the relevant questions. Nevertheless, the survey outcome may be affected by the self-selection of the respondents who completed the money attitude inventory. Average scores on the money attitude scale, for example, will be biased if the answers of respondents differ from the potential answers of those who broke off the interview. The existence of such a non-response bias can be tested by comparing the group of non-respondents to the group of respondents who completed the money attitude inventory. For this purpose, several demographic characteristics of the two groups have been compared. Mean values and the results of a

group means comparison test are shown in Table 6-8. The respondents who completed the money retention scale are significantly younger and have higher levels of education than those who dropped out. In terms of income, household size and gender the null hypothesis of equal means cannot be rejected. The systematic exclusion of older individuals with lower levels of education has to be kept in mind when analysing the survey results. At the same time, the fact that the mean values of all other variables which may impact a person's answers to the money attitude questions, especially income, are broadly the same in both groups is a satisfactory result.

Table 6-8: Non-response bias and money attitudes

Variable	**Non-respondents** (N=80) **mean**	**Respondents** (N=1113) **mean**[1]	**T-test of equal means across groups** **p-value**
Male	0.425	0.517	0.114
Age	43.700	39.087	0.007
Han nationality	0.963	0.911	0.112
Higher education	0.288	0.417	0.023
Household size	3.088	2.907	0.271
Monthly disposable household income in 1,000 RMB	8.026	8.865	0.393

[1] Mean in the relevant split-samples before discarding questionnaires with missing information

In a next step, one needs to verify that the six items of the modified money retention scale measure a single construct. This is done by calculating Cronbach's alpha, which is a commonly used indicator of internal consistency of a psychometric scale. The alpha of the modified money retention scale is 0.817, indicating that the covariance of the six items is high. Scales with alphas above 0.800 are usually interpreted as being highly reliable; at the same time, high alphas may also indicate a redundancy among items in the inventory (c.f. Switzer et al., 1999). Looking at the correlations among the six statements there is indeed a strong statistical relationship between several of these items. As indicated by the correlation coefficients reported in Table 6-9, there is a close association between the first and the second item as well as between the second and the fourth item.

Table 6-9: Correlations among items of the money attitude inventory

Items	**Pearson's correlation coefficient**				
	Q1	**Q2**	**Q3**	**Q4**	**Q5**
Q1 I often have difficulty to bring myself to spend money regardless of the amount.					
Q2 In making any purchase, for any purpose, spending money is painful …	0.637				
Q3 I often say 'I can't afford it' whether I can or not.	0.410	0.472			
Q4 Even when I have enough money I often feel guilty if I spend money…	0.440	0.526	0.432		
Q5 I feel compelled to argue or bargain about the cost of almost everything I buy.	0.393	0.451	0.320	0.406	
Q6 Money should be saved not spent.	0.414	0.447	0.296	0.394	0.367

Note: All $p<0.01$

Furthermore, a principal component factor analysis has been undertaken to verify the relationship among the six items. It is expected that all six items form a one-dimensional construct, namely the degree to which a person dislikes spending money in principle. In view of the outcome of the correlation analysis, the result of the factor analysis displayed in Table 6-10 comes as little surprise; all items clearly load on a single factor. This result points to the construct validity of the measure. Besides the results of the factor analysis, mean scores on the single items as well as the sample's average score on the money retention scale are shown in the same table. With the exception of the fifth item all average scores are lower than 3 ('neither agree nor disagree') and thus below the midpoint of the Likert scale. In other words, an average respondent disagreed with most money attitude statements. The relatively higher mean score of the fifth item is plausible since the statement refers to the habit of bargaining about prices, which is, in contemporary China, still normal in many purchase situations. In addition to observing mean scores, insights into the distribution of misers in the sample can be gained from observing the share of respondents who agreed with the single items, i.e. who chose either 'predominantly true' or 'completely true' from the answer scale. As expected, only a minority of respondents agreed with the different items. However, all item-specific proportions are of statistical importance. Agreement with the six items ranges from 19.4% to 39.2%. Even the apparently irrational statement 'Even when I have enough money I often feel guilty if I spend money on necessities' was approved by one fourth of the respondents. Regarding the entire money attitude inventory, an average score of 4 and higher indicates that a respondent has, on average, agreed with all six statements. Scores of 4 and higher are rare but still of statistical importance. Taking an average score of 4 and higher as an indicator for a person's pathological tendency to retain his or her

financial resources, it is concluded that approximately 11.2% of the respondents fall into this category.

In order to judge the plausibility of these results the sample's average score on the modified money attitude inventory shall be compared to mean scores reported in other studies which have employed a similar set of money attitude questions. In virtually all existing surveys, an average respondent scored just below the midpoint of the Likert scale (cf. section 5.3.2, Table 5-4). Wiepking and Breeze (2012), for example, reported a mean score of 2.6 out of 5 points for a representative sample of Dutch households. Hoon and Lim (2001) published a score of 3.6 out of 7 points for Singaporean respondents, which corresponds to a score of approximately 2.6 on a 5-point scale. Even though these studies were conducted in very different socio-cultural contexts than the present survey, the resemblance of the results from Beijing with previous surveys on money attitudes can be viewed as further evidence for the validity and reliability of the employed measure.

Table 6-10: Money attitude structure from principal component factor analysis

Items	**Agreement**[1] **(%)**	**Mean**	**Std. dev.**	**Factor loading**
Q1 I often have difficulty to bring myself to spend money regardless of the amount.	34.7	2.883	1.347	0.771
Q2 In making any purchase, for any purpose, spending money is painful …	21.0	2.458	1.248	0.831
Q3 I often say 'I can't afford it' whether I can or not.	19.4	2.419	1.187	0.665
Q4 Even when I have enough money I often feel guilty if I spend money…	26.5	2.594	1.278	0.742
Q5 I feel compelled to argue or bargain about the cost of almost everything I buy.	39.2	3.083	1.302	0.663
Q6 Money should be saved not spent.	24.2	2.625	1.125	0.664
Average score[2]	11.2[3]	2.679	0.918	

[1] Proportion of respondents who ticked '(4) predominantly true' or '(5) completely true' on the Likert scale
[2] The average score generally equals the sum of item-specific scores divided by the total number of answered items. If the answer to one single item was missing, the average score was calculated based on the five remaining items.
[3] Share of respondents with an average score of ≥4

Another possible way of assessing the validity of the money attitude measure consists of observing interrelationships of the measure with other variables. For this purpose, the money attitude score has been regressed against several respondent characteristics. Based on psychological theory and the results of former studies, it is expected that the score on the money attitude scale systematically varies with certain demographic variables such as gender and age. Furthermore, the score should be essentially unrelated to a respondent's objective financial situation, like

disposable household income and household size. The results of the OLS regression model used to verify these hypotheses are displayed in Table 6-11.

Table 6-11: Determinants of the money attitude score

Dependent variable: MONEYATT	**Coefficient**	**Standard error**
CONSTANT	3.527***	0.134
MALE	-0.094***	0.050
AGE	0.005***	0.002
EDU	-0.208***	0.020
INCOME	-0.019***	0.003
HH_SIZE	0.035*	0.019
	R^2=0.185	
	N=1100	

Note: *p≤0.10; **p≤0.05; ***p≤0.01

The regression coefficients of almost all demographic variables are highly significant. Conforming to prior expectations, the money attitude score is related to respondents' gender (MALE). Women reach higher scores on the scale than men, ceteris paribus on other factors. Similar results were also reported in previous studies (e.g. Furnham, 1984, Lim et al., 2003). Furthermore, AGE has a significant effect on the money attitude score. The finding that money retention is more common in the older generation than in the younger is plausible, given the context of the present study. Many elderly people in China have experienced pervasive poverty during the years following the Cultural Revolution. Since it is reasonable to believe that the preference for non-spending is more developed among those who lived in poverty in the past (cf. Lim et al., 2003), the effect of age on the money attitude score is not surprising at all. In addition to that, traditional Chinese values like thrift and frugality can be expected to be more widespread among the older generations. Another key determinant of the money retention score is a respondent's level of education (EDU). The score decreases by approximately 0.2 points with each of the seven different levels of education assessed in the survey. In contrast to many previous studies on money attitudes, there is a significant negative effect of INCOME on the score on the money retention scale. Furthermore, the money attitude score increases with the number of people living in a respondent's household (HH_SIZE). While the relationship between a person's age and gender is in line with initial expectations, the effects of education, household size and income are somewhat troubling, given the theory underlying the psychological construct and the results of previous studies. In the present application, the preference for non-spending seems to be a function of several socio-economic characteristics, especially of those that are obviously related to respondents' welfare, and not an independent personality trait. In view of this result, the question arises how to correctly interpret high scores on the modified money attitude inventory. Rather than indicating that a respondent suffers from a compulsion to retain his or her money, high levels of agreement with the six money attitude items may simply reflect that a person is not able to

spend money in most purchase situations due to his or her limited financial resources. Accordingly, a high money retention score does not necessarily point to miserliness.

When observing the correlation of the six items underlying the overall money attitude variable with the demographic characteristics of concern, it is to be noticed that the correlation coefficients are of differing magnitude. This is especially the case for the variable of most concern in terms of the interpretability of the money retention score, which is a respondent's disposable household income. As reported in Table 6-12, there is a relatively high correlation between INCOME and the first two items of the modified money attitude inventory. The correlation coefficient is, however, smaller than 0.2 in the case of the remaining four items. This means that agreement with the first two items, i.e. 'I often have difficulty to bring myself to spend money (…)' and 'In making any purchase, for any purpose, spending money is painful for me', is particularly likely to reflect a respondent's inability to spend a lot of money rather than a pathological tendency to retain his or her financial resources. By contrast, agreement with the remaining six items may be a more genuine expression of miserliness.

Table 6-12: Correlations of money attitude items and demographic variables

Items	**Pearson's correlation coefficients**				
	MALE	**AGE**	**EDU**	**INCOME**	**HH_SIZE**
Q1 I often have difficulty to bring myself to spend money…	-0.083***	0.232***	-0.366***	-0.268***	0.088***
Q2 In making any purchase, for any purpose, spending money is painful …	-0.075**	0.152***	-0.349***	-0.238***	0.036
Q3 I often say 'I can't afford it' whether I can or not.	-0.031	0.098***	-0.220***	-0.188***	0.051*
Q4 Even when I have enough money I often feel guilty…	-0.092***	0.055*	-0.236***	-0.194***	0.027
Q5 I feel compelled to argue or bargain about the cost…	-0.087***	0.110***	-0.246***	-0.177***	0.008
Q6 Money should be saved not spent.	-0.021	0.112***	-0.268***	-0.139***	0.053*
MONEYATT	-0.092***	0.177***	-0.391***	-0.279***	0.061**

Notes: *p≤0.10; **p≤0.05; ***p≤0.01

To explore the content validity of the modified money retention inventory further, the scale was discussed during three CEG meetings, namely in the two sessions before the main survey and in the session following the main survey. In addition to adapting the wording and the contents of the scale to the Chinese context (cf. section 6.2.2), particular attention was paid to the question whether the six items indeed measured the money attitude facet they were supposed to measure. Most importantly, the citizen experts were asked to give their opinion how to interpret high money retention scores. The CEG members generally agreed that the six items described the

rather uncommon tendency to systematically refrain from spending money on anything. They also approved my hypothesis that respondents' attitudes towards spending money in general influenced their WTP statements in CVM interviews. They said that people who found spending money painful in everyday purchase situations would also feel uncomfortable when agreeing to pay a particular amount of money for the 'Tarim Environmental Preservation Plan'. When presented the results of the main survey, which clearly show that respondents' attitudes towards spending money in general affect their answers to the payment question (cf. section 6.4.3), the citizen experts were not surprised at all. They found it very plausible that high-scorers were less likely to agree with the payment question than others. One participant stressed that he had expected that even more misers would have refused to make a financial contribution to the TEPP. However, there was disagreement concerning the interpretation of high scores on the modified retention scale. According to several citizen experts, agreement with the relevant items sould be viewed as an indicator of miserliness only in the case of respondents who dispose of sufficient financial resources. In the case of poor respondents, however, a high score on the scale most likely reflects a person's inability to spend money and not his or her tendency to refrain from spending for the sake of miserliness, according to the CEG. Other citizen experts did not question the validity of the attitudinal variable but emphasised that most misers in Beijing had good reasons for acting stingy – namely an extremely tight budget.

In brief, the modified money attitude inventory used to measure money spending dispositions in the CVM survey carried out in Beijing performs well regarding the common indicators for a psychometric scale's reliability and validity such as internal consistency and construct validity. However, there are also a number of issues which have to be taken into account when analysing the survey outcome. Firstly, there is sample selection; the fact that lower educated and elderly people are systematically excluded from the analysis because they did not answer the set of money attitude questions affects the representativeness of the results. For example, the sample's average score on the money retention scale is likely to be downwardly biased since age is positively and education negatively correlated with this score. Secondly, a person's score on the money attitude scale turned out to be systematically related to several demographic characteristics as well as to the financial situation of a respondent's household. The results of the present study show, in contrast to many former applications, that money retention systematically relates to disposable household income. Hence, merely exploring the effect of money retention scores on WTP and other variables of interest would be misleading. The variables that are immediately related to a respondent's score on the money attitude inventory always need to be controlled for when assessing the effect of the money attitude variable on a dependent variable econometrically. Furthermore, a researcher may think of using only those money attitude items which show the lowest relationship with the income variable in order to obtain a more genuine measure of miserliness. However, constructing the money attitude variable based on a lower number of items goes along with decreasing levels of the measure's internal consistency. Therefore, the six-item-variant has been maintained for the econometric analysis presented in the next sections. To

explore the robustness of the key results of the following applications, a sensitivity analysis has been conducted as well. All models used to explore the effect of money retention on WTP have been replicated using a shortened, less income-sensitive variant of the money attitude variable. The psychometric property of this variable as well as the results of this sensitivity analysis can be found in the appendix, section 8.1.

6.4.2 Money retention and monetary habits

Before exploring the effect of money attitudes on stated WTP, the relationship between this variable and everyday situations involving money shall be scrutinised. To get a better understanding of how miserliness affects people's economic behaviour in general, the answers to several questions concerning spending and saving habits have been regressed against the money attitude variable. Table 6-13 shows the results of the different regression models. In line with former studies on money retention, the money attitude variable (MONEYATT) has a significant impact on several habitudinal variables, even when controlling for gender, age, education, income and household size.

The first dependent variable of interest is FINMGMT which takes higher values the better a respondent judged the financial situation of his or her household ('How well would you say your household is managing financially these days?'). Ceteris paribus, people with a higher money retention score are more pessimistic regarding their household's financial situation. In other words, stingy respondents are the less likely to judge their households' financial situation as 'really good'. On the one hand, these pessimistic attitudes may reflect a miser's insatiable desire to accumulate money and permanent dissatisfaction with his or her income and wealth. On the other hand, this result could also indicate that people with high money retention scores are financially worse off as compared to low-scorers, thereby further adding to the concerns regarding the scale's content validity.

Further, the relationship between the money attitude variable and a person's saving habits is of central interest. From the economic perspective, not spending is interpreted as saving for future consumption. From the psychological perspective, not spending either reflects a person's desire to financially prepare for the future, i.e. saving in the economic sense, or presents a pathological tendency to retain one's financial resources, i.e. miserliness. To get more insights regarding the meaning of the money attitude variable used here, people's reported saving habits have been regressed against their scores on the money retention scale. The likelihood that a person saves part of his or her income on a regular basis (SAVE) is unaffected by the money attitude variable. Regarding different saving strategies ('Concerning your saving habit, which description fits?'), the most popular way of saving, namely to 'save the money that is left over at the end of a month' (SAVE_RESIDUAL) is unaffected by a person's money attitude. Stingy people are as likely as those with un-conflicted attitudes towards spending to pursue this saving strategy. However, saving 'as much as possible' (SAVE_AMAP) is more popular among misers than among other respondents. The likelihood that a respondent chose 'I save as much as possible', as the item which describes his or her saving habits best, significantly increases with the money

retention score. In contrast to that, saving 'a fixed amount each month' (SAVE_FIXEDA) is largely unrelated to a person's attitudes towards spending. When comparing the latter two saving strategies, saving 'a fixed amount' may reflect rational planning for future consumption. Saving 'as much as possible', in contrast, might be an irrational outcome of miserliness. At the same time, saving 'as much as possible' could also represent the only feasible way of saving when a person has an extremely tight budget. Although it is possible that individual respondents interpreted the meaning of this item differently, it is still conspicuous that this potentially ill-founded saving strategy is significantly more popular among misers than among respondents with a low score on the money retention scale.

In addition to querying saving regularity and saving strategies, the questionnaire also contained a number of questions regarding different saving purposes, such as precautionary saving, saving for one's children or saving for retirement ('Why do you save money? How are you going to spend your savings?'). Since no significant relationship between a person's money retention score and the different saving purposes has been detected, the corresponding regression models are not reported in this section. Taken together, the survey results show that money retention is mostly unrelated to saving habits. Misers are as likely as other consumers to regularly save parts of their income and saving purposes hardly differ across the two groups. Merely the rather uncommon saving strategy to save 'as much as possible' is more common among high-scorers than among other respondents.

Apart from different saving practices, attitudes towards spending money on others is of particular interest for the present study. This is because stated WTP for environmental projects has some similarity with donating money to charities or even buying gifts for other people. In CVM surveys, similarly to the case of donations and gift-giving, altruism and/or the feeling of warm-glow are likely to matter for a respondent's stated WTP. Several psychologists argued that many people perceive spending money on others differently from spending money on themselves, presumably because of altruistic feelings mediating their stingy attitudes. Goldberg and Lewis (1978), for example, extensively discussed the attitudes and habits of the so-called 'self-denier', a type of person who behaves miserly in situations involving personal consumption but who tends to act generously towards others (cf. section 4.1.2). According to the authors, self-deniers generally refuse to spend money on things they would enjoy personally but are often willing to buy gifts for their friends and to make generous donations to charity. To test whether a person's score on the money retention scale is related to spending money on others, the results of survey questions on generosity and donation behaviour are analysed next. As displayed in Table 6-13, the money attitude variable is a significant predictor of self-report generosity (GENEROUS: 'I am generous with people I love') and the warm-glow variable (WARMGLOW: 'I get a good feeling from contributing money to all kind of good causes'). In both cases, MONEYATT has a significantly negative effect on the dependent variable. This is to say that misers are less generous than low-scorers; and that they are less likely to experience the warm-glow of giving when contributing money to good causes. Hence, the argument made by some psychologists regarding

the existence of so-called self-deniers seems to be of limited concern in the present study. While the theory postulates that people with strong preferences for non-spending are not necessarily stingy when it comes to spending money on others, the survey results indicate that misers are, on average, also less generous with other people. Accordingly, the proportion of self-deniers in the sample must be rather low. Hence, the hypotheses regarding the negative impact of stinginess on stated WTP still sounds plausible. The next section focuses on the effect of the money attitude variable on people's answers to the WTP elicitation question.

Table 6-13: Money retention and monetary habits

Dependent variable:	**FINMGMT**	**SAVE**	**SAVE_RESIDUAL**	**SAVE_FIXEDA**	**SAVE_AMAP**	**WARMGLOW**	**GENEROUS**
Regression model:	OLS	Probit	Multinomial Probit[1]	Multinomial Probit[1]	Multinomial Probit[1]	OLS	OLS
Variables				**Coefficient (Standard error)**			
CONSTANT	2.971***	-0.677**	-1.557***	-1.405***	-2.148***	3.488***	4.252***
	(0.166)	(0.270)	(0.405)	(0.476)	(0.496)	(0.235)	(0.184)
MALE	0.000	-0.137*	-0.205*	-0.121	-0.207	-0.015	0.003*
	(0.049)	(0.080)	(0.119)	(0.139)	(0.143)	(0.069)	(0.054)
AGE	0.003*	0.011***	0.026***	-0.005	0.002	0.007***	0.004
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.002)	(0.002)
EDU	0.052**	0.098***	0.101**	0.126	0.083	-0.055*	-0.012
	(0.021)	(0.034)	(0.051)	(0.059)	(0.061)	(0.030)	(0.023)
INCOME	0.030***	0.021***	0.023***	0.029***	0.032***	-0.007	0.003
	(0.003)	(0.006)	(0.009)	(0.009)	(0.010)	(0.005)	(0.004)
HH_SIZE	0.004	0.010	0.033	-0.004	-0.042	0.056**	0.027
	(0.018)	(0.030)	(0.044)	(0.052)	(0.054)	(0.026)	(0.020)
MONEYATT	-0.176***	-0.014	-0.095	0.015	0.287***	-0.097**	-0.081**
	(0.029)	(0.048)	(0.071)	(0.087)	(0.087)	(0.042)	(0.032)
N	1064	1070	1067	1067	1067	1053	1057

Notes: *p≤0.10; **p≤0.05; ***p≤0.01

[1] The categorical variable SAVING_STRAT is used as dependent variable in the multinomial probit model. 'Not saving at all' is used as the base category. The coefficients refer to the likelihood of choosing the category of interest, i.e. SAVE_AMAP, SAVE_FIXEDA or SAVE_RESIDUAL, over the base category.

6.4.3 Money retention and WTP

In a first step, attitudes towards spending money in general will be analysed as an additional respondent characteristic which is expected to affect a person's stated WTP. To test the first hypothesis (H1), i.e. whether or not money retention affects the likelihood of agreeing with the referendum question asked in the CVM survey considered here, the money attitude score (MONEYATT) derived from the modified money retention scale is integrated into a probit model to assess the validity of the WTP data. Regression coefficients, standard errors and marginal effects of the explanatory variables are shown in Table 6-14.

Table 6-14: Money retention and WTP

Dependent variable: WTP1	**Model 2**			**Model 3**		
Variable	**Coefficient**	**Standard error**	**dy/dx**	**Coefficient**	**Standard error**	**dy/dx**
CONSTANT	1.919***	0.359		1.251***	0.392	
BID	-0.007***	0.001	-0.002	-0.007***	0.001	-0.002
TREAT	0.195**	0.086	0.063	0.162*	0.088	0.051
MALE	0.157*	0.084	0.051	0.167*	0.086	0.053
AGE	0.006*	0.003	0.002	0.004	0.003	0.001
EDU	0.033	0.037	0.011	0.034	0.038	0.011
INCOME	0.001	0.006	0.000	0.001	0.006	0.000
HH_SIZE	0.049	0.031	0.016	0.039	0.032	0.012
NONUSE	0.484***	0.121	0.157	0.390***	0.124	0.123
PROTEST	-0.363***	0.053	-0.117	-0.333***	0.055	-0.105
MONEYATT	-0.255***	0.051	-0.083	-0.251***	0.053	-0.079
WARMGLOW				0.187***	0.040	0.059
SAVE				0.075	0.089	0.024
Log-Likelihood	-608.939			-586.619		
Pseudo R^2	0.175			0.192		
N	1068			1051		

Notes: *p≤0.10; **p≤0.05; ***p≤0.01

The coefficient of MONEYATT is negative and highly significant in the first model (Model 2 in Table 6-14). Thus, keeping the bid, income, household size and all other control variables constant, the likelihood of agreeing with the payment question decreases when the money retention score increases. The marginal effect of MONEYATT indicates that the likelihood of agreeing with the payment question decreases by 8% when the money retention score increases by one point. Hence, respondents with a higher tendency to retain their money have a lower WTP. The effect of MONYATT remains robust when including additional, potentially intervening variables into the regression model. In Model 3, a variable indicating the level of agreement with the

warm-glow question (WARMGLOW) and a dummy variable indicating whether or not a respondent regularly saves money (SAVE) are added (cf. Table 6-14, Model 3). In line with the results of previous CVM studies, WARMGLOW has a positive and highly significant effect on WTP. The sign of the coefficient for SAVE is also positive but saving habits do not significantly affect a person's WTP. The significance level and the marginal effect of MONEYATT remain broadly the same in the extended model, indicating that money retention is not mediated by good feelings resulting from the act of contributing money to a good cause. Thus, even after including two supposedly confounding variables, the effect of MONEYATT remains robust. These results indicate that there is indeed a negative relationship between tightness with money and WTP.

To verify the second hypothesis, which states that the probability of stating a zero WTP is related to a person's disposition to spend money in principle (H2), two additional regression models have been estimated. Just as in the models considered before, the dependent binary variable analysed in models 4 and 5 refers to a respondent's answer to the referendum question. However, the dependent variable (WTP2) takes a value of 1 for 'yes' and 'no, but' replies; and 0 for no-replies. Hence, these two models give more insights into the key determinants of a positive WTP statement, i.e. a person's general willingness to contribute money to the TEPP.

In spite of the treatment dummy, a respondent's gender and age, the determinants for a person's general WTP are the same as the variables that have a significant effect on the likelihood of answering 'yes' to the referendum question, which has been analysed in the previous models. BID and PROTEST have significant negative effects; NONUSE increases the likelihood of stating a positive WTP. Surprisingly, the sign of the coefficient for INCOME is negative but, as before, this effect is not significant.

In contrast to this somewhat puzzling role of INCOME, the variable MONEYATT behaves in the expected way. The higher a respondent's score on the money retention scale, the lower is the probability of stating a positive WTP. As before, the effect of MONEYATT remains robust when additional control variables are included into the model (cf. Table 6-15, Model 5). Interestingly, a respondent's saving habits (SAVE) have a positive effect on general WTP. Respondents who reported to save regularly are more likely to state a positive WTP than their counterparts. This effect may be rooted in the fact that people who attach great importance to financially preparing for the future are, on average, also more concerned about the future state of the environment. Therefore, the finding that regular savers are more likely to support the Tarim project than others is plausible. This result also shows that thrift, in the sense of saving for future needs, affects people's general WTP in the opposite way than miserliness.

Table 6-15: Money retention and zero bids

Dependent variable: WTP2	**Model 4**			**Model 5**		
Variable	**Coefficient**	**Standard error**	**dy/dx**	**Coefficient**	**Standard error**	**dy/dx**
CONSTANT	3.090***	0.405		2.587***	0.437	
BID	-0.003***	0.001	-0.001	-0.003***	0.001	-0.001
TREAT	-0.047	0.091	-0.013	-0.085	0.094	-0.023
MALE	-0.007	0.090	-0.002	0.002	0.092	0.001
AGE	0.002	0.003	0.000	0.000	0.003	0.000
EDU	0.015	0.039	0.004	-0.002	0.040	-0.001
INCOME	-0.007	0.006	-0.002	-0.008	0.006	-0.002
HH_SIZE	0.055	0.035	0.015	0.044	0.036	0.012
NONUSE	0.510***	0.129	0.142	0.407***	0.133	0.109
PROTEST	-0.463***	0.062	-0.129	-0.447***	0.064	-0.120
MONEYATT	-0.251***	0.054	-0.070	-0.237***	0.055	-0.064
WARMGLOW				0.149***	0.042	0.040
SAVE				0.315***	0.094	0.085
Log-Likelihood	-528.110			-502.763		
Pseudo R^2	0.119			0.138		
N	1068			1051		

Notes: *p≤0.10; **p≤0.05; ***p≤0.01

All in all, the results of the regression analysis support the two hypotheses concerning the effect of money spending dispositions on WTP: WTP is lower the more unwilling a person is to spend money in principle. In addition to that, money retention negatively affects the likelihood of stating a positive WTP. In the present CVM study, attitudes towards spending money in general, measured with the help of the modified money retention scale, is as a useful and highly significant predictor for people's answers to the WTP elicitation question. Unlike disposable household income, which has no significant effect on respondents' answers to the referendum question as soon as some basic control variables are included into the regression models, the money attitude variable affects response behaviour in a consistent and robust way.

Finally, the third hypothesis regarding the average WTP of misers merits attention. Since the likelihood of agreeing with the referendum question decreases with an individual's score on the money retention scale, it can be inferred that average WTP in the group of high-scorers is lower than in the group of low-scores. However, the question whether or not the WTP of people with high levels of money retention is zero cannot be answered at this stage. To test the third hypothesis (H3), group-specific average WTP[20] has been calculated.

[20] Computing group-specific average WTP from DC-data poses some problems. Firstly, the number of observations per group is actually too low to obtain statistical efficient WTP estimates. Secondly, agreement with the referendum

As reported in Table 6-16, mean WTP is the highest in the group of respondents with the lowest scores on the money retention scale and the lowest in the group of respondents with the highest scores. This difference is statistically significant and also remains obvious when comparing group-specific average WTP as a share of group-specific average income. While those respondents who disagreed with all six items of the money attitude inventory are willing to contribute approximately 1.4% of their monthly disposable household income, this figure shrinks to 0.9% for the group of respondents who agreed with the entire set of items. Average WTP of high-scorers significantly differs from the sample's average WTP, too. Respondents with money retention scores of 4 and higher stated to pay 60 RMB less than an average respondent. Another conspicuous difference across the four groups is the proportion of zero bids. The share of respondents with a zero WTP increases only slightly when comparing the group with the lowest money retention scores to the two groups with intermediate scores. However, there is a veritable jump in the proportion of zero WTP statements from the intermediate clusters to the group of the stingiest respondents. In this group, the share of zero bids amounts to 46.3%, which is almost twice as high as the share of zero bids in the overall sample. Nevertheless, the group's average WTP of 41 RMB per month is positive and statistically different from zero. Hence, the third hypothesis turns out to be wrong in the case of the data analysed here. In the present study, the WTP of misers is low but positive.

Furthermore, the argument that the WTP statements of misers is irresponsive to price (cf. section 5.4.2) must be partly refuted. As can be inferred from the coefficients referring to the bid variable displayed in the first row of Table 6-16, the answers of all respondents, including the group of very stingy respondents, are affected by the bid level. The corresponding coefficient is negative and highly significant across *all* groups of respondents. In terms of its magnitude, the effect of the bid variable on WTP is even the highest in the group of misers. However, in line with initial expectations, it can be shown that this effect becomes insignificant when disregarding the two lowest bids (10 and 25 RMB). Hence, as predicted, the answers of misers are unrelated to the 'price' of the environmental project whenever this price is significantly high. However, it cannot be excluded that stingy respondents who were assigned one of the higher bids (i.e. 50 to 200 RMB) rejected the referendum question because they could not afford to pay rather than because of their distorted money attitudes.

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question does not follow an optimal distribution in certain of the groups. For example, in the group of respondents with the highest money retention score, agreement with the lowest bid is too low and rejection of the highest bid is too high. The partly huge confidence intervals displayed in Table 6-16 reflect these issues.

Table 6-16: Money retention and average WTP

Money retention score	1 to <2	2 to <3	3 to <4	4 to 5	Total sample
N	221	471	255	121	1068
β (coefficient of BID)	-0.005***	-0.008***	-0.006***	-0.009***	-0.007***
Mean WTP (in RMB)	163	109	74	41	101
95% confidence interval[1]	[126; 249]	[93; 127]	[42; 100]	[2; 68]	[89; 114]
WTP/INCOME	1.43%	1.10%	1.10%	0.85%	1.13%
WTP=0[2]	18.6%	21.4%	26.7%	46.3%	24.9%

Notes: ***p≤0.01
[1] Calculated with the Krinsky and Robb procedure (cf. Haab and McConnell, 2002: 110-113)
[2] Share of respondents who ticked 'No, my household does not tolerate any increase of its monthly expenditures in order to get the TEPP realized'

Taken together, it is still not clear whether the WTP statements of respondents with high scores on the money retention scale are a genuine expression of the utility change that these individuals would experience if the environmental project in question was realised. The fact that the WTP of misers is positive indicates that the majority of respondents in this group were willing to make a (hypothetical) trade-off between money and environmental quality, at least when asked whether they would tolerate to pay a relatively low amount of money (i.e. less than 50 RMB). Hence, the data analysed here provides little evidence that stingy people make lexicographic choices when answering the WTP elicitation question during a CVM interview. If the preference ordering of such people is not lexicographic but in line with neoclassical theory, the WTP statements of misers can be interpreted in the common way. This is to say that the significantly lower average WTP of misers reveals that this group of people would benefit less from more sustainable oasis management in the Tarim Basin than other Beijing citizens. The next section explores whether or not the latter interpretation makes sense.

6.4.4 WTP statements of misers: A genuine expression of preferences?

The results of the CVM survey conducted in Beijing show that money retention has a strong impact on stated WTP. However, it is still an open question whether or not the presence of misers in the sample affects the validity of the overall WTP estimate. On the one hand, the low WTP of stingy respondents might reveal an ill-founded view and use of money which prevents these persons from expressing the true value they attribute to the TEPP in monetary units. In this case, WTP would not be an expression of the utility increase accruing from this environmental project but would merely reflect the disutility of depleting one's piggy bank. On the other hand, the group of respondents with high scores on the money retention scale may gain little or no utility from the TEPP, for example because these people do not believe in the project's effectiveness or because they do not perceive its non-use values. Furthermore, it could be the case that high-scores are simply more careful when it comes to spending, even in hypothetical situations. High-scorers might be more likely to take into account their budget constraint than others and to think more deeply about the opportunity costs of their consumption choices. Naturally, preferring to

spend one's financial resources for other purposes than contributing them to the TEPP is a valid reason for rejecting the referendum question. Accordingly, if it turns out that respondents with high money retention scores derive less utility from the environmental improvement than from other goods, which they could purchase with the same amount of money, their WTP statements represent unbiased welfare measures. To analyse which of the two explanations is more plausible, the present section explores the relationship between the money retention score and several debriefing questions. For this purpose, the relationship between money spending dispositions and a number of valid reasons for rejecting the payment question shall be analysed in a first step. Afterwards, more problematic variables will be explored.

Different variables that have been constructed based on respondents' answers to questions regarding their motivation of voting in favour or against the TEPP have been regressed against the money attitude variable and several control variables. Table 6-17 shows the results of seven econometric models. MONEYATT is a predictor of merely two of the seven dependent variables under consideration, namely of the variable NODOUBT, which reflects the level of agreement with a debriefing statement regarding the project's effectiveness ('Environmental conditions in the Tarim area will improve through the TEPP') and the dummy variable OPPCOST, which takes the value of 1 if a respondent has considered the opportunity costs of his or her choice and 0 otherwise ('Did you consider other things that you could buy for … RMB?'). Hence, people with higher money retention scores have more doubts about the effectiveness of the TEPP and are also more likely to think about the next best use of the amount of money they are asked to give up in exchange for the environmental improvement. As explained above, both motivations represent valid reasons for rejecting the payment question. However, questioning the effectiveness of the TEPP may indicate protest against this environmental project and the related payment rather than serious doubts regarding the planned policy measures. A more careful weighing of the benefit of the environmental project against the costs of paying money for its implementation seems to be a more plausible reason why the WTP of misers is relatively low. Survey participants who think carefully about the consequences of their choice before answering the WTP elicitation question are, of course, highly desirable from the perspective of a CVM researcher and there is no reason for questioning the validity of the WTP statements of such respondents.

Table 6-17: Money retention and debriefing questions

Dependent variable:	**OV**[1]	**AV**[1]	**BV**[1]	**EV**[1]	**NODOUBT**[2]	**AFFORD**[1]	**OPPCOST**[1]
Regression model:	Probit	Probit	Probit	Probit	OLS	Probit	Probit
Variables					**Coefficient (Standard error)**		
CONSTANT	-0.087	-0.284	-0.307	-0.168	4.645***	0.357	-0.936
	(0.272)	(0.268)	(0.272)	(0.268)	(0.207)	(0.268)	(0.275)
BID	-0.001	0.000	0.000	-0.001	0.000	0.000	0.001**
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
MALE	0.122	-0.045	-0.002	0.036	-0.039	0.104	0.139*
	(0.079)	(0.078)	(0.079)	(0.078)	(0.060)	(0.078)	(0.080)
AGE	-0.011***	0.000	0.005*	0.006**	0.006***	0.001	-0.010***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
EDU	0.077**	0.063*	0.082**	0.070**	-0.106***	-0.007	0.022
	(0.034)	(0.033)	(0.034)	(0.033)	(0.026)	(0.033)	(0.034)
INCOME	0.000	-0.002	0.003	-0.010*	-0.005	-0.005	-0.013**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.055)	(0.006)
HH_SIZE	0.020	0.056*	-0.001	-0.029	0.024	-0.025	0.056*
	(0.029)	(0.029)	(0.029)	(0.029)	(0.022)	(0.025)	(0.030)
MONEYATT	-0.061	-0.081*	0.021	-0.034	-0.082**	-0.070	0.295***
	(0.061)	(0.047)	(0.047)	(0.047)	(0.036)	(0.047)	(0.048)
N	1070	1070	1070	1070	1066	1068	1070

Notes: *p≤0.10; **p≤0.05; ***p≤0.01
[1] Dummy variable (1=yes, 0=no)
[2] Measured on a five-point Likert scale (1=strongly disagree, 5=strongly agree)

At the same time, the money attitude variable has hardly any impact on the perception of the project's long-distance benefits, i.e. its non-use values. There is no indication that misers are less likely to perceive the project's option, bequest or existence value (OV: 'Did you consider your chances of visiting the Tarim area some day in the future?' BV: 'Did you consider the TEPP's positive effects for future generations?' EV: 'Did you consider the TEPP's positive effects for plants and animals?'). However, people with high money retention scores are less likely to perceive the altruistic value of the environmental project (AV: 'Did you consider the TEPP's positive effects on the living conditions of local people?'). The latter result fits the picture of a stereotypical miser drawn by psychotherapists, namely that of an egoistic self-focused person who does not care about his or her social environment. Moreover, the money attitude variable does not significantly affect the likelihood of considering one's budget constraint before answering the payment question (AFFORD). It is to be noticed that only half of all respondents answered 'yes' when asked 'Did you consider whether your household can afford to pay higher taxes?' and that the likelihood of agreement is unaffected by the bid level. This result reveals that many respondents overlooked their budget constraint or perceived the randomly assigned bid amount as insignificant. It is, however, odd that the probability of considering one's budget constraint is unrelated to a person's score on the money retention scale. One explanation for this result would be that two opposing effects are at work. Some misers may have thought carefully about their household's actual ability to pay; other misers may have followed their habit of refusing to spend money on anything without thinking of their household's objective ability to pay. If this explanation holds true, the effect of the money attitude variable on AFFORD will cancel out.

Apart from valid reasons for stating a low or zero WTP, the relationship between the money retention score and several motivations for rejecting the referendum question that pose issues in terms of the validity of the WTP data have been explored. In addition to the genuine reasons considered above, negative attitudes towards the payment scenario and the CVM interview as a whole are expected to explain why some respondents made low or zero WTP statements. In contrast to the reasons considered previously, the presence of respondents with such negative attitudes may threaten the validity of the CVM survey (cf. the discussion on protesting in section 2.3.2). In order to explore whether misers are particularly likely to share negative attitudes towards the payment scenario and the CVM interview, a number of variables reflecting protest as well as some variables regarding a respondent's behaviour during the interview have been regressed against the money attitude variable, thereby controlling for the standard set of demographic variables and the bid level. The results of the corresponding OLS regression models are displayed in Table 6-18. Taken as a whole, it is quite impressive that the money attitude variable has, in contrast to all other factors included in these regression models, great explanatory power for all six dependent variables under consideration.

Respondents with higher money retention scores are more likely to agree with the three protest statements included in the questionnaire. The money attitude variable has a significantly positive effect on the level of agreement with the statements 'Poor households should not have to

pay for the TEPP' (PROTEST1); 'Not households, but central government alone should pay for the TEPP' (PROTEST2); and 'Taxes are already so high that increasing taxes is not a good way to finance the program' (PROTEST3). The relationship between money spending dispositions and protest attitudes is little surprising. People who hate spending money in general plausibly also object to the idea of paying money for an environmental project. These results reveal that misers have, on average, a greater tendency to reject the key aspects of the payment scenario. Thus, more widespread protest in the group of misers is likely to be another reason for the relatively low average WTP in this group.

Given psychoanalysts' and psychotherapists' observations that clients who suffer from some money-related pathology mostly dislike talking about issues involving money, it is expected that a CVM interview, especially disclosing one's WTP for an environmental project, is a rather unpleasant experience for a miser. The data obtained from the set of questions filled in by the interviewers regarding a respondent's behaviour during the interview strengthens this concern. The results of the regression models displayed in Table 6-18 indicate that respondents with higher scores on the money retention scale took the interview less seriously (MOTIV1), that they got angry more often when asked whether their household would support the TEPP financially (MOTIV2) and that these respondents more frequently pretended that the environmental project was not of their business (MOTIV3). This finding is particularly perturbing in view of the validity of the WTP data. It appears questionable that the answers of respondents who reacted very negatively to the referendum question represent valid WTP statements. Taken together, the analysis of protest statements and respondents' behaviour during the interview backs the hypothesis that misers are rather unpleasant respondents. As expected, the hypothetical payment question more often provoked negative reactions when the respondent was stingy.

In sum, there is mixed evidence regarding the question whether or not the WTP statements of extremely stingy respondents are biased. On the one hand, stinginess is related to several valid reasons for stating a low or zero WTP, most notably, a careful weighing of the environmental project's benefits and the opportunity cost of supporting the project. In addition to that, the relatively low WTP of high-scorers appears plausible because these respondents are also more sceptical about the effectiveness of the environmental project. On the other hand, respondents with a great inhibition against spending money are as likely as others to perceive the benefits accruing from the TEPP to the citizens of Beijing, which are mainly existence and bequest values, indicating that both groups of individuals would experience an increase in utility if this environmental project was implemented. However, stingy respondents are especially likely to hold protest beliefs and to behave awkwardly during the CVM interview. Given these mixed findings, it is hard to decide whether zero WTP statements made by respondents with extremely high scores on the money retention scale should remain in the sample when computing the overall social value of the environmental project.

Table 6-18: Money retention, protest and behaviour during the interview

Dependent variable:	**PROTEST1**[1]	**PROTEST2**[1]	**PROTEST3**[1]	**MOTIV1**[2]	**MOTIV2**[2]	**MOTIV3**[2]
			Coefficient[3]			
			(Standard error)			
Variables						
CONSTANT	3.181***	3.393***	3.151***	4.267***	0.878***	1.437***
	(0.268)	(0.237)	(0.234)	(0.159)	(0.184)	(0.206)
BID	0.001	0.001	0.001***	-0.001**	0.002***	0.001***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MALE	0.006	-0.113	0.017	-0.031	0.001	-0.034
	(0.078)	(0.069)	(0.002)	(0.046)	(0.054)	(0.060)
AGE	0.003	0.003	-0.001	0.004**	0.002	-0.001
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
EDU	0.047	0.039	0.108***	0.020	0.049**	-0.019
	(0.033)	(0.029)	(0.029)	(0.020)	(0.023)	(0.026)
INCOME	0.006	-0.001	0.007	0.004	0.003	0.001
	(0.005)	(0.005)	(0.005)	(0.003)	(0.004)	(0.004)
HH_SIZE	-0.025	0.006	0.026	-0.003	0.011	0.005
	(0.029)	(0.026)	(0.025)	(0.017)	(0.020)	(0.022)
MONEYATT	0.105**	0.151***	0.072*	-0.081***	0.142***	0.216***
	(0.047)	(0.041)	(0.041)	(0.028)	(0.032)	(0.036)
N	1070	1070	1070	1064	1064	1064

Notes: *p≤0.10; **p≤0.05; ***p≤0.01
[1] Measured on a five-point Likert scale (1=strongly disagree, 5=strongly agree)
[2] Measured on a five-point Likert scale (1=completely wrong, 5=completely true)
[3] Coefficients and standard errors of OLS regression models

6.4.5 Discarding miser zeroes

In the last section the relationship between money attitudes and attitudes towards the environmental project and the related payment has been explored. Even though the survey results indicate that respondents with high scores on the retention scale have reported partly valid reasons for stating a zero WTP, it also turned out that the answers to the elicitation question in the group of misers should be handled with some care. Despite having broadly identical impressions of the environmental project, misers are more likely to hold protest beliefs and get het up over the payment question than other respondents. Hence, the proportion of biased WTP statements, i.e. answers to the elicitation question which do not reflect the utility increase a respondent expects to experience through the environmental improvement in question, is likely to be higher among misers than among other respondents. Thus, it may be recommendable to exclude the answers of misers when estimating the sample's average WTP and analysing its determinants. However, excluding the answers of a particular group of respondents from the WTP data often affects the

representativeness of the sample and inevitably comes at the cost of reducing the sample size. In view of these issues discarding potentially biased WTP statements, like meaningless zeroes or implausibly high bids, is not very common in CVM research. However, in the following a 'discarding experiment' shall be performed; the potentially biased zero bids of respondents with extremely high scores on the money retention scale will be dropped from the sample. Average WTP, its determinants as well as the sample's representativeness will be assessed and analysed anew.

As argued in chapter 5, the existence of misers in a CVM sample as such does not necessarily threaten the validity of the survey result. Miserliness only poses problems in the case that respondents who hate spending money in general refuse to pay anything on the hypothetical market, even though obtaining the environmental good that is 'sold' on this market would increase their utility. Therefore, potentially biased responses are zero bids stated by stingy respondents. In contrast to that, positive WTP statements made by misers pose fewer issues because they reveal that these stingy individuals are generally willing to make a trade-off between money and environmental quality. Following this logic, the remainder of this section focuses on discarding the zero WTP statements of misers.

In the sample there are 56 respondents with an extremely high score on the money retention scale who stated a zero WTP, i.e. who selected 'No, my household does not tolerate any increase of its monthly expenditures in order to get the TEPP realised' when answering the referendum question. Naturally, the definition of 'extremely high' is very subjective and involves the somewhat random selection of a cut-off point. A certain score on the money attitude scale needs to be chosen in order to divide the sample into a group of misers and a group of respondents with unobjectionable money attitudes. In the following application, respondents with a score of 4 and higher on the 5-point Likert scale, i.e. respondents who, on average, agreed with all six statements of the modified retention scale, are counted as misers. After having discarded 56 misers from the sample (= 5.2% of the sample), the sample size shrinks to 1,014 observations and 1,012 valid WTP statements. The characteristics of the discarded and the remaining data are summarised in Table 6-19. A first thing to be noted is that the respondents whose answers have been deleted from the sample make up a group of apparently disadvantaged citizens. They are mostly female, older than the individuals in the adjusted sample, only a few have enjoyed higher education and their monthly disposable income amounts to only 4,142 RMB, which is less than half of the income of the remaining respondents. Once again, it must be doubted that a high score on the modified retention scale unambiguously indicates miserliness. It may, to at least some extent, reflect a respondent's disadvantaged position in society.

Regarding the demographic characteristics of the respondents in the adjusted sample, none of the key variables (GENDER, AGE, EDUCATION, HH_SIZE and INCOME) is, as indicated by the results of a means comparison test, significantly affected by the discarding procedure. Thus, the representativeness of the sample is not immediately affected by the selection process.

Nevertheless, it should be kept in mind that the adjusted data does not account for the preferences of some of the particularly disadvantaged members of Beijing's urban population.

Table 6-19: Sample characteristics subsequent to data cleansing

Variable	**Full sample (N=1070)**	**Discarded observations (N=56)**	**Adjusted sample (N=1014)**	**T-test of equal means across samples**
	mean	**mean**	**mean**	**p-value**
	(std. deviation)	**(std. deviation)**	**(std. deviation)**	
Bid level	89.014	95.892	88.634	0.828
	(68.546)	(66.845)	(86.650)	
Male	0.519	0.411*	0.525	0.672
	(0.500)	(0.496)	(0.500)	
Age	38.920	46.089***	38.525	0.328
	(14.707)	(12.651)	(14.717)	
Higher education	0.410	0.125***	0.426	0.302
	(0.492)	(0.334)	(0.495)	
Household size	2.912	3.179	2.898	0.743
	(1.404)	(1.130)	(1.416)	
Monthly disposable household income (in 1,000 RMB)	8.871	4.142***	9.133	0.347
	(8.315)	(2.949)	(8.415)	

Notes: Mean significantly different from mean in the adjusted sample at *99%, **95%, ***90% significance level

Running the univariate regression model presented in section 6.3.2 (cf. Table 6-6) for the adjusted sample yields a slightly higher WTP estimate than previously. Mean WTP now amounts to 112 (95% confidence interval: [100; 125]) RMB per month, which does not significantly differ from the original value of 102 RMB. Thus, deleting potentially biased zero WTP statements from the sample does not markedly affect Beijing households' average WTP for the restoration of the natural environment along the Tarim River. It should be noted, however, that working with the higher WTP estimate derived from the adjusted sample makes a huge difference when computing the overall value of the environmental project for the entire megacity. Multiplying the WTP estimate by the total number of registered households in urban Beijing (2.8 million households, cf. section 6.2.1) yields an overall value of 183.6 million RMB for the entire sample and of 201.6 million RMB for the adjusted, 'miser-free' sample.

Furthermore, it is interesting to explore whether discarding the potentially biased answers given by misers affects the construct validity of the survey. Regarding the determinants of WTP, it might be the case that the magnitude and the significance level of some of the effects, which are typically viewed as indicators for construct validity, have changed. For example, it can be speculated that the income effect, which lacked significance previously, becomes observable when discarding respondents whose WTP is suspected to be neither related to their incomes nor

to the environmental project in question. Therefore, the basic regression model presented in section 6.3.2 (cf. Table 6-7) has been run again using the adjusted data set. However, as can be seen from Table 6-20, the determinants of WTP remain broadly the same in the adjusted sample as in the full sample. In line with the results of the initial regression model, the bid (BID), the treatment variable (TREAT), a respondent's gender (MALE), education (EDU), the consideration of nonuse values (NONUSE) and protest against the payment scenario (PROTEST) are significant predictors of WTP. Moreover, unlike before, a respondent's age (AGE) now has a significant effect on WTP. The new regression model suggests that older respondents have a higher WTP than younger respondents, possibly because awareness of the environmental and social problems in the Tarim Basin is more widespread among the older generations in Beijing. This plausible effect had not been observable when using the full sample, possibly because of the presence of many stingy elderly respondents. Nevertheless, there is still no observable income effect. Thus, there is no clear evidence that the validity of the WTP data has increased after having discarded the zero WTP statements of misers from the sample. The fit of the regression model, as indicated by the pseudo R^2, however, slightly increases when using the adjusted sample (+0.005).

Table 6-20: Determinants of WTP (adjusted sample)

Dependent variable: WTP1	**Model 6**	
Variable	**Coefficient**	**Standard error**
CONSTANT	1.039***	0.320
BID	-0.007***	0.001
TREAT	0.257***	0.088
MALE	0.171**	0.086
AGE	0.007**	0.003
EDU	0.064*	0.036
INCOME	0.003	0.006
HH_SIZE	0.049	0.032
NONUSE	0.492***	0.124
PROTEST	-0.351***	0.054
Log-Likelihood	-580.993	
Pseudo R^2	0.163	
N	1012	

Notes: *p≤0.10; **p≤0.05; ***p≤0.01

Taken together, discarding the potentially biased WTP statements from the sample hardly makes a difference in the present study. Neither average WTP nor its determinants substantially change. The finding that the sample's demographic characteristics remain broadly the same subsequent to the removal of presumably invalid observations shows that adjusting the CVM data does not pose issues in terms of the sample's representativeness either. Naturally, this finding is likely to be specific to the present study where the number of misers who stated a zero WTP is, based on the classification rule employed, relatively small.

6.5 Implications and recommendations

In this chapter the role of money attitudes in CVM surveys has been analysed empirically. Using econometric techniques it has been shown that individual dispositions to spend money in principle have a statistically significant effect on WTP statements. In the present study, WTP decreases the more unwilling a person is to spend money in general. Furthermore, the likelihood of stating a positive WTP is also negatively affected by a person's tendency to retain his or her money. Respondents with an extremely high score on the money retention scale (approximately 11% of the sample) answered the payment question in a different manner than expected; their average WTP amounts to 41 RMB per month and is significantly different from zero. Nevertheless, the WTP of people with lower scores, and hence more ordinary attitudes towards spending money, is almost three times higher. It is astonishing to see how robust the effect of the money attitude variable is in the present study. Unlike a respondent's disposable income, which has hardly any observable effect on WTP, money spending dispositions affect the answers to the payment question in a consistent way, even when controlling for several demographic and attitudinal factors which could be expected to confound, mediate or dominate this effect.

The data provides little evidence that people with high money retention scores use a lexicographic decision rule when answering the payment question. In the present study, even extremely stingy people played the game in the sense of making hypothetical trade-offs between money and environmental quality. Thus, the existence of misers within the sample does not immediately threaten the validity of the WTP estimate. Still, it was found that misers were more likely to share a number of characteristics which are rather undesirable from a CVM practitioner's perspective. For example, the money attitude variable, which has been used as an indicator for miserliness, is systematically related to protest beliefs. At the same time, this variable is essentially unrelated to a person's attitudes towards the environmental project in question. For instance, the perception of non-use values accruing from more sustainable oasis management in the Tarim Basin is broadly unaffected by respondents' levels of money retention. Thus, the low average WTP of misers cannot exclusively be explained by the possibility that this particular group of people would benefit less from the prospective environmental improvement than others. Rather than being the result of different levels of appreciation of the environmental good in question, the substantial gap between the WTP of ordinary respondents on the one hand, and the WTP of misers on the other, seems to relate to the agglomeration of undesirable forms of behaviour and attitudes in the latter group of respondents. Negative reactions to the payment question, objection against several aspects of the payments scenario and indifference about the valuation task turned out to be systematically related to higher scores on the money retention scale.

Given these findings researchers may think of discarding the possibly biased WTP statements of misers from the data. As exemplarily shown at the end of section 6.4, deleting the zero bids of misers has practically no consequences for the results of the CVM survey considered here. In view of its insignificant effect on the sample's average WTP and the determinants of WTP, deleting or maintaining the possibly biased observations hardly makes a difference. However, even

though it does not significantly affect the sample's representativeness, the data cleansing implies that the preferences of some of the most disadvantaged members of Beijing's urban population would be neglected when evaluating the long-distance benefit of more sustainable water management in the Tarim Basin. This is because the group of high-scorers who stated a zero WTP consists of mainly poor elderly respondents with relatively low levels of education. In view of their socio-demographic characteristics, especially their low incomes, it must be doubted that these people rejected the payment question exclusively for the sake of miserliness. Possibly, most of them were simply too poor to express their preferences for the environmental good in terms of money. Hence, discarding the WTP statements of respondents with a high score on the retention scale is not recommendable in the case of the present study.

Naturally, the present application has some limitations so that the results regarding the role of money attitudes in CVM surveys cannot be generalised very easily. First of all, the sample is not random. Therefore, some of the reported results, like the estimators derived from the econometric models, may be biased. Secondly, respondents were interviewed in public; their answers might be influenced by several factors such as road noise or other people's comments. Furthermore, the absence of a significant income effect on people's agreement with the referendum question is somewhat disturbing – not only in view of the validity of the WTP estimate but also in relation to the effect of the money attitude variable. The robustness of the effect of the retention variable on WTP might be partly due to the absence of a significant income effect; and the lacking income effect, in return, could be the consequence of a measurement error inherent to the income variable.

However, given the explanatory power of money spending dispositions for the results of the CVM survey considered here, future studies should consider this psychological variable as well. For this purpose, a suitable inventory needs to be integrated into the CVM questionnaire. As shown in this chapter, six short statements are largely sufficient to assess a respondent's disposition to spend money in general. In view of the high correlation between several of the statements used in the present study, even a lower number of items are likely to yield a valid measure. As shown in the appendix, using a shortened variant of the money attitude variable yields broadly the same results as those presented in the present chapter. The modified version of Furnham's (1984) retention-subscale yielded satisfactory results in the present study but this measure definitely needs further refinement. One of the main drawbacks is the surprisingly strong correlation of the money retention scores with several demographic variables, especially with disposable household income. The latter correlation makes the interpretation of high scores on the money retention scale difficult. A high score may point to miserliness but also to poverty. It might also be useful to ask the set of money attitude questions at the very beginning of an interview, i.e. even before assessing a respondent's WTP. This is because the group of respondents who is particularly likely to hold negative attitudes towards spending money, namely elderly and less educated people, is also more likely to break off the interview subsequent to the WTP elicitation question. In addition to paying attention to adequately measuring the money attitude facet of

interest, it appears to be of particular importance to correctly account for the socio-demographic factors which immediately relate to this variable. Especially a respondent's financial resources should be carefully assessed, if possible not only by a single question regarding a respondent's disposable household income but also by assessing alternative measures such as a person's monthly salary and total wealth.

To summarise, this chapter provides new insight into the effect of respondents' attitudes towards spending money on stated WTP. Money retention, measured by means of a six-item inventory adapted from social psychology, proved to be a useful predictor for stated WTP. The study finds some evidence that the WTP statements of extremely stingy respondents may be biased but there are also several indicators of the inexistence of such distortions. Hence, rather than being a source of bias, attitudes towards spending money appear to be respondent characteristics which plausibly affect the results of CVM surveys and contribute to a better understanding of the driving factors of people's answers to hypothetical payment questions.

7 Summary and conclusion

This study made a first attempt to scrutinise the role of money attitudes in survey-based environmental valuation studies. It provided a comprehensive theoretical and empirical analysis of the impact of respondents' money attitudes on the results of contingent valuation surveys. It mainly focussed on one particular money attitude facet, namely individuals' dispositions to spend money in general.

While money attitudes have been extensively explored in psychological literature, economic research on this topic is extremely rare. In view of the role money plays in the traditional branches of economics – a medium of exchange which individuals desire exclusively for the purpose of spending it for present or future consumption – it comes as little surprise that money attitudes have never been investigated in the context of environmental valuation studies. Even though it appears quite plausible that respondents' attitudes towards spending money influence their answers to payment questions, no existing stated preference study has tested for this relationship. The present study therefore addressed the impact of money attitudes on WTP statements theoretically in a first place, thereby reviewing, comparing and integrating the economic and the psychological approaches to analyse people's behaviour with money. Researchers from both disciplines have pointed to the existence of misers in society, i.e. people who enjoy accumulating money and hate spending it for anything in any situation. While economists usually disregard this phenomenon when analysing spending decisions, psychoanalysts and social psychologists have made efforts to identify, explain and treat this neurotic money attitude. The comprehensive review of the psychological literature on people's behaviour with money showed that the existence of misers in the general population may raise issues in survey-based environmental valuation studies. Misers were suspected to reject the valuation task, which is the key element of any environmental valuation survey, because of their somewhat impalpable desire to accumulate money. Their WTP was hypothesised to be completely unrelated to the environmental improvement in question and a pure expression of their distorted money attitudes. Besides the potentially biasing effect of miserliness on the results of stated preference surveys, it was expected that people's dispositions to spend money in general affect their WTP for environmental improvements, at least in the case of realistic and consequential surveys. The stingier a person is the lower his or her WTP will be, according to the hypothesis. For these reasons measuring attitudes towards spending money in CVM surveys and testing their impact on WTP statements appeared to be of great relevance. The empirical part of this study therefore provided a comprehensive analysis of the impact of respondents' attitudes towards spending money on their answers to the payment question asked during a CVM interview.

The introductory chapter exposed the motivation for a study on contingent valuation and money attitudes. Chapter 2 provided a more detailed introduction to environmental valuation in general and to contingent valuation, a methodology which makes use of extensive interviews during which respondents are directly asked to state their WTP for a specific environmental

improvement, in particular. The chapter illustrated the theoretical foundations as well as more practical aspects of CVM research. As a survey-based method, CVM is prone to a lot of criticism. However, the factors which threaten the validity of WTP statements have been extensively studied and are nowadays relatively well understood. Among other things, CVM practitioners identified a number of problems related to assessing the value people attach to environmental changes in terms of money. These problems include some people's refusal to make trade-offs between environmental quality and money. Hence, former studies dealt with similar distorting effects as the one considered in this dissertation. However, certain individuals' strong inhibition against spending money in general has never been discussed as a potential source of bias in stated preference studies. The chapter closed with an introduction of participatory approaches which are helpful to reduce sources of bias when preparing a CVM survey and to develop and interpret survey questions aimed to identify biased responses, such as the WTP statements of misers.

In view of the multidisciplinary nature of this dissertation, the following two chapters provided an overview of the economic and the psychological approach to analyse people's behaviour with money. Chapter 3 explored the role of money in economics. As illustrated by the medium of exchange theory presented in the first section, the primary role of money in economic theory consists of facilitating the exchange of goods and services. From this perspective, rational individuals never desire money for its own sake but only for the things they can buy with it. This so-called neutrality postulate shapes both the micro- and the macroeconomic branch of the discipline. The second section showed that the economic analysis of consumer choice is based on the assumption that an individual's utility is determined only by the level of consumption and not by the amount of money held in, for example, a savings account. Likewise, macroeconomists predict the effects of monetary policy based on the assumption that holding money serves one single purpose, namely spending it in the future. Since money is mainly analysed as a medium of exchange in economics, it is hardly surprising that money attitudes, especially those that may challenge the neutrality postulate, play no major role in economic literature. However, some behavioural economists proposed alternative approaches to analyse people's behaviour with money. In the 1960s Schmölders' (1982) already highlighted the importance of accounting for individual differences in money spending dispositions when analysing people's consumption and saving behaviour. More recently, a group of behavioural economists pointed anew to the existence of 'tightwads', i.e. people who perceive the act of spending money as very painful (Prelec and Loewenstein, 1998, Rick et al., 2008, Rick, 2013). Experiments and surveys demonstrated that tightwads spend systematically less money than others, indicating that a so-called pain of paying drives people's behaviour with money.

Chapter 4 reviewed the psychological literature on money. Although there is far less systematic research on money in psychology than in economics, some interesting studies on people's money-related habits and emotions were identified. Analysing people's attitudes towards money has a relatively long tradition in psychoanalytical literature. At the beginning of the twentieth century psychoanalysts like Freud ([1908] 1976) and Ferenczi ([1914] 1976) already published

articles on money-related pathologies, like hoarding and neurotic overspending. In addition to describing and explaining such money pathologies, clinicians developed typologies and questionnaires in an attempt to identify and classify their clients' money-related problems. As explained in the second part of the chapter, psychoanalytical theories and typologies triggered and influenced the analysis of money-related attitudes in a broader context than the clinical context. Starting in the 1980s, social psychologists developed instruments to measure different facets of money attitudes and conducted empirical studies to analyse the distribution and the determinants of these facets in society. Most of the existing instruments explicitly account for so-called money retention. They contain sets of items describing the habits of misers and ask respondents to indicate their agreement with these items on Likert scales.

Chapter 5 put the concept of money attitudes into the environmental valuation context. The most prominent attitude facets discussed in the psychological literature on money were analysed with respect to their possible influence on people's spending decisions and their potentially distorting effect on WTP for environmental improvements. Based on this analysis, only miserliness could be suspected to systematically affect and possibly bias WTP. Afterwards, two approaches of modelling the behaviour of misers when 'purchasing' an environmental good were proposed. The first approach integrated money, as a desirable good, into the standard neoclassical utility function. The second approach employed the less commonly used concept of lexicographic preferences, thereby treating money as the primarily desired good. Both approaches yield similar predictions regarding the magnitude of a miser's WTP but have different consequences for the validity of WTP. Both models anticipate that misers have an extremely low or zero WTP for environmental goods. However, only lexicographic choices, in the sense that misers systematically prefer the status quo situation to the environmental project and the related payment, thereby ignoring the characteristics and magnitude of the environmental improvement in question, challenge the validity of WTP. If stingy respondents indeed applied lexicographic decision rules, a miser's zero WTP would be unrelated to the environmental improvement in question and thus meaningless. Naturally, this potential source of bias only merits attention if the share of misers in a society is sufficiently large. To gain more insights into the distribution of misers in the general population, dozens of empirical studies on money spending dispositions published during the last three decades were considered. Still, this literature review provided no definite answer regarding the actual relevance of miserliness. However, it backed the hypothesis that money retention matters for people's actual behaviour with money. Given the results of former empirical studies on related topics, it was concluded that this money attitude facet probably also affects people's stated WTP for environmental projects. The chapter closed with a presentation of several research questions and hypotheses to be tested in a representative CVM survey.

The role of attitudes towards spending money was finally analysed empirically in a CVM survey conducted in China in 2013. Chapter 6 analysed the results of 1,070 intercept interviews, which were based on a standardised questionnaire containing an adjusted version of Furnham's (1984) money retention scale. The original question inventory had to be modified slightly and

translated from English into Mandarin Chinese. Participatory approaches and several rounds of pretests contributed to the gradual improvement of a Chinese six-item variant of the money retention scale. The modified retention scale showed good levels of internal consistency and the corresponding variable proved to be logically related to several money-related habits assessed in the survey. While the latter result pointed to the scale's validity, there were also a number of unexpected, partly distorting relationships between the attitudinal variable and certain socio-demographic variables, including significant negative correlations with income and education levels. The finding that high levels of money retention were particularly widespread among economically disadvantaged people raised issues in terms of the interpretation of the money attitude variable. It appeared quite possible that high scores on the retention scale did not only indicate strong inhibitions against spending money as a consequence of miserliness but reflected also some respondents' very tight budget constraints. In view of this weakness the importance of controlling for respondents' socio-economic characteristics when testing the effect of the money attitude variable on WTP by means of regression analysis was stressed. The multivariate regression models provided evidence for most of the theoretical predictions regarding the relationship of money retention and respondents' answers to the hypothetical payment question. Higher levels of money retention went along with lower WTP amounts. Furthermore, higher levels of money retention increased the probability that respondents stated a zero WTP. Nevertheless, the study provided no evidence that respondents with extremely high levels of money retention state, on average, a zero WTP. Even though the proportion of zero WTP was by far the largest in the group of high-scorers, mean WTP in this group was significantly different from zero. In view of this result, there was prima facie no evidence that misers used lexicographic decision rules when answering the payment question and hence no evidence of a lack of construct validity. However, the WTP statements of high-scorers raised other issues. Stingy respondents were more likely to hold protest beliefs against some aspects of the payment scenario. Furthermore, the interviewers reported that higher levels of money retention increased the likelihood that respondents were infuriated when asked about their WTP, that they did not take the payment question seriously and pretended that answering this question was none of their business. However, the survey results did not indicate that stingy respondents would benefit less from the environmental improvement in question than others. Hence, the comparatively low WTP in the group of respondents with high scores on the retention scale did not seem to reflect minor expected utility gains from the environmental project to be valued. Instead, low WTP in this group appeared to be mainly a result of strong inhibitions against spending money in general, which in return induced more widespread protest beliefs and anger over the payment question. The empirical application closed with suggestions and an exemplary demonstration regarding the treatment of respondents with extremely high scores on the money retention scale when analysing the survey data.

In brief, this study identified attitudes towards spending money as a key determinant of stated WTP. However, it found mixed evidence regarding the question whether or not the WTP statements of extremely stingy respondents are biased. Since the present study makes use of the

results of one single CVM survey, these results cannot be generalised easily. Furthermore, the empirical application has several limitations, most importantly the weaknesses of the instrument used to measure money retention. The correlation of the money attitude with respondents' disposable household income and education level poses problems. Given these correlations, it cannot be ruled out that in the present study, high scores on this variable reflect money retention due to a low income rather than pure miserliness. An unambiguous distinction between misers, who hate spending money, on the one hand and poor people, who are not able to spend money because of their tight budgets, on the other is, however, crucial. While a low income is typically considered a legitimate reason for stating a zero WTP (see Bateman et al., 2002: 146), miserliness may cause bias. Future research should concentrate on refining the money retention scale or on developing a more suitable instrument to measure miserliness. This instrument could then be used to test whether or not the effect of the money attitude variable on stated WTP discovered in the present study can be reproduced in other applications. It would be interesting to see if similar relationships between money spending dispositions and WTP exist in CVM surveys on other kinds of environmental improvements carried out in different socio-cultural contexts than the Chinese one.

Moreover, it appears promising to assess the effect of money spending dispositions on WTP by means of alternative elicitation formats. The present study employed a variant of the referendum format, namely 'trichotomous choice' (Loomis et al., 1999). This format allows for an identification of zero WTP statements but gives only limited information regarding the distribution of positive WTP statements. Group-specific average WTP, like average WTP of stingy respondents, can be estimated econometrically. However, the precise WTP of the individual group members remains unknown. Alternative payment formats, like the payment card, provide more insights into the magnitude of individual WTP statements. The hypothesis that misers state a zero or insignificantly low WTP should be tested anew by means of a payment card which contains a zero answer option and intervals accounting for extremely low WTP amounts. If the predictions developed in the present study hold true, misers will always choose one of the lowest amounts from the payment card.

In addition to their role in CVM surveys, individual differences in money spending dispositions are likely to also affect the results of studies that make use of other environmental valuation techniques. It is expected that the relationship between money retention and WTP is also observable in simulated market experiments involving actual transactions and in surveys employing other stated preference techniques. It would be interesting to compare the effect of the money attitude variable on stated WTP to its effect on real payments in simulated market experiments. It is likely that more misers would refuse to make trade-offs between money and environmental quality in an experimental setting where they are asked to actually spend money, as compared to the purely hypothetical situation of a CVM interview. Moreover, the existence of misers among the participants of a choice experiment might pose similar problems as in CVM surveys. Presumably, misers always choose the status quo option, which implies no increase in expenditures,

when presented a choice set. Like misers' zero WTP statements in CVM surveys, such choices are meaningless from the analyst's perspective if they do not reveal the utility increase misers expect to experience from the different policy options displayed on a choice set. Lexicographic decision rules – the concept used in this dissertation to theoretically represent the behaviour of extremely stingy respondents when given the possibility to 'purchase' an environmental good – have been extensively discussed in the context of choice modelling (e.g. Jedidi and Kohli, 2008, Sælensminde, 2006, Yoo and Ready, 2014). Several studies reported that many respondents consistently choose the policy option that is best with respect to one particular attribute, like the lowest expenditure increase, thereby ignoring the remaining attributes (attribute non-attendance, see e.g. Hensher et al., 2012). Lexicographic decision rules seem to simplify the choice task respondents have to perform in stated preference interviews and certain respondent characteristics have proved to explain such choice behaviour (cf. Rosenberger et al., 2003). High levels of money retention may be another so far overlooked explanation for attribute non-attendance in choice experiments and should therefore be analysed in this context.

Finally, besides money retention, other money attitude facets may also affect stated WTP for environmental improvements. A future study could address, for instance, individual differences in the importance attached to saving for future needs as well as the habit of boasting about one's income and wealth, i.e. the foresight-dimension and the power-dimension of the established money attitude inventories. In the present study only the effect of retention, which has been identified as the money attitude facet with the most obvious and most problematic relationship to WTP, has been assessed empirically. As explained in chapter 5 neither high scores on the foresight facet nor on the power facet are likely to distort the results of an environmental valuation study. However, it cannot be ruled out that power and foresight also have an impact on stated WTP. For example, greater concern for future financial security may go along with more concern for prospective environmental quality and hence higher WTP for public projects with prospective environmental impacts. Likewise, respondents who like boasting about their financial resources may state higher WTP than modest respondents, possibly because they want to impress the interviewer or because they stick to their habit of overspending.

In conclusion, this study provides a starting point for analysing money attitudes in the context of CVM surveys. It links different scientific approaches of analysing people's behaviour with money. The empirical application shows that accounting for individual differences in money spending dispositions in CVM surveys is relatively simple. Integrating a short question inventory into the CVM questionnaire suffices to construct a variable with substantial explanatory power for stated WTP. However, the present study also demonstrates very clearly that the corresponding items need to be carefully designed. Future research on accurately accounting for money spending dispositions and the extreme case of miserliness in survey-based environmental valuation studies is therefore needed.

8 Appendix

8.1 Sensitivity analysis

Table 8-1: Money attitude structure from principal component factor analysis (shortened inventory)

Items	Agreement[1] (%)	Mean	Std. dev.	Factor loading
Q3 I often say 'I can't afford it' whether I can or not.	19.4	2.419	1.187	0.708
Q4 Even when I have enough money I often feel guilty if I spend money…	26.5	2.594	1.278	0.765
Q6 Money should be saved not spent.	24.2	2.625	1.125	0.747
Average score[2]	11.0[3]	2.707	0.923	
Cronbach's alpha	0.588			

[1] Proportion of respondents who ticked '(4) predominantly true' or '(5) completely true' on the Likert Scale
[2] The average score generally equals the sum of item-specific scores divided by the total number of answered items. If the answer to one single item was missing, the average score was calculated based on the two remaining items.
[3] Share of respondents with an average score ≥4

Table 8-2: Determinants of the money attitude score (shortened inventory)

Dependent variable: MONEYATT2	OLS regression coefficient	Standard error	Pearson's correlation coefficient
CONSTANT	3.453***	0.139	
MALE	-0.059	0.052	-0.064**
AGE	0.004**	0.002	0.143***
EDU	-0.182***	0.021	-0.331***
INCOME	-0.015***	0.003	-0.228***
HH_SIZE	0.028	0.019	0.049
	R^2=0.128 N=1102		

Note: *p≤0.10; **p≤0.05; ***p≤0.01

Table 8-3: Money retention and WTP (sensitivity analysis)

Dependent variable: WTP1	**Model 6**			**Model 7**		
Variable	**Coefficient**	**Standard error**	**dy/dx**	**Coefficient**	**Standard error**	**dy/dx**
CONSTANT	1.693***	0.351		1.008***	0.384	
BID	-0.007***	0.001	-0.002	-0.007***	0.001	-0.002
TREAT	0.184**	0.085	0.060	0.153*	0.088	0.049
MALE	0.168**	0.084	0.055	0.177**	0.085	0.056
AGE	0.005*	0.003	0.002	0.004	0.003	0.001
EDU	0.050	0.036	0.016	0.051	0.037	0.016
INCOME	0.003	0.006	0.001	0.003	0.006	0.001
HH_SIZE	0.042	0.031	0.014	0.034	0.032	0.011
NONUSE	0.485***	0.120	0.158	0.390***	0.124	0.124
PROTEST	-0.366***	0.053	-0.119	-0.333***	0.054	-0.106
MONEYATT2	-0.188***	0.049	-0.061	-0.183***	0.050	-0.058
WARMGLOW				0.186***	0.040	0.059
SAVE				0.085	0.089	0.027
Log-Likelihood	-614.403			-591.332		
Pseudo R^2	0.169			0.186		
N	1069			1051		

Notes: *p≤0.10; **p≤0.05; ***p≤0.01

Table 8-4: Money retention and zero bids (sensitivity analysis)

Dependent variable: WTP2	**Model 8**			**Model 9**		
Variable	**Coefficient**	**Standard error**	**dy/dx**	**Coefficient**	**Standard error**	**dy/dx**
CONSTANT	2.955***	0.396		2.464***	0.428	
BID	-0.003***	0.001	-0.001	-0.003***	0.001	-0.001
TREAT	-0.054	0.091	-0.015	-0.090	0.094	-0.024
MALE	0.002	0.089	0.000	0.010	0.092	0.003
AGE	0.001	0.003	0.000	-0.001	0.003	0.000
EDU	0.028	0.039	0.008	0.007	0.040	0.002
INCOME	-0.005	0.006	-0.001	-0.007	0.006	-0.002
HH_SIZE	0.049	0.034	0.014	0.040	0.036	0.011
NONUSE	0.516***	0.128	0.144	0.409***	0.133	0.110
PROTEST	-0.461***	0.061	-0.129	-0.441***	0.064	-0.119
MONEYATT2	-0.220***	0.051	-0.061	-0.215****	0.053	-0.058
WARMGLOW				0.150***	0.042	0.040
SAVE				0.329***	0.094	0.089
Log-Likelihood	-530.111			-503.791		
Pseudo R^2	0.116			0.137		
N	1069			1051		

Notes: *p≤0.10; **p≤0.05; ***p≤0.01

8.2 CVM Questionnaire

The empirical part of this dissertation makes use of data gathered by means of an intercept CVM survey in Beijing in 2013. This survey was part of the Sino-German research project SuMaRiO (BMBF-Funding Measure 'Sustainable Land Management', LLA2-02). A standardised questionnaire was used to assess Beijing citizens' WTP for more sustainable oasis management in the Tarim Basin. This questionnaire had been jointly developed by the project leaders Michael Ahlheim and Oliver Frör, in cooperation with the project assistant Sonna Pelz and the Chinese counterparts Jiang Tong and Luo Jing. The following is a short version of the full questionnaire. Maps, pictures as well as text passages, questions and inventories that are not relevant for this dissertation are not displayed.

1. Demographic questions

1.	The respondent's gender	○ (1) Male ○ (0) Female
2.	How long have you been living in Beijing?	_____ years
3.	Where do you live in Beijing?	○ (1) Dongcheng ○ (2) Xicheng ○ (3) Chaoyang ○ (4) Fengtai ○ (5) Shijingshan ○ (6) Haidian
4.	Which is your home province?	○ (1) Beijing ○ ( ) _____
5.	What is your year of birth?	Year of birth: _____
6.	Which ethnic group do you belong to?	○ (1) Han ○ ( ) _____
7.	Which is your highest level of education?	○ (1) I didn't graduate from Primary School ○ (2) Primary School ○ (3) Junior High ○ (4) Senior High ○ (5) College Graduate ○ (6) Bachelor Degree ○ (7) Master Degree (or higher)
8.	What marital status do you have?	○ (1) I am married and live together with my spouse ○ (2) I am married and live separated from my spouse ○ (3) I am not married ○ (4) I am divorced ○ (5) I am widowed
9.	What is your employment situation?	○ (1) Employee ○ (2) Civil servant ○ (3) Teaching stuff / Researcher ○ (4) Self-employed ○ (5) Trainee / student ○ (6) Retired worker without a job ○ (7) Unemployed

10.	How many persons do actually live in your household in Beijing, including yourself?	_____ persons
11.	How many children (i.e. minors without an income of their own) live in your Beijing household?	_____ children

2. Water issues in the Tarim Basin: Personal experience

With the following questions we want to investigate people's awareness of environmental problems in remote areas of China. We chose the Tarim Basin in Xinjiang A.R. as an example. This small map shows the location of the Tarim Basin. Here you can see the Tarim River which gives its name to the great basin.

12.	Have you ever heard about the Tarim River?	○ (1) Yes ○ (2) Not sure→ *go to part 3* ○ (3) No → *go to part 3*
13.	Have you ever been to the Tarim area?	○ (1) Yes ○ (0) No → go to Q15
14.	Why did you go there? *Int: tick all options that apply*	○ (1) Living ○ (2) Tourism ○ (3) Visiting family or friends ○ (4) Work ○ (5) Other
15.	Have you ever heard about environmental problems in the Tarim area?	○ (1) Yes ○ (0) No

3. Water shortage and environmental situation in the Tarim Basin

The state of the environment in the Tarim area might also affect the feelings of people living far away. We would like to find out what Beijing residents think personally about the actual land and water use practices in the Tarim area, and if they are personally willing to support a more sustainable policy.

Now, I am going to give you some more information about the Tarim River and its natural environment. The Tarim Basin is an extremely dry and vulnerable region due to very little rainfall. Agriculture, life in the oases cities, as well as nature therefore depend on water from the Tarim River, the longest inland river in China.

The typical vegetation along the Tarim River consists of riparian forests and grasslands. Certain native herbs that can be found in the grasslands can be used as fiber and medicine. The riparian forests consist of shrubs and poplar trees. The roots of these plants hold the soil together, even during floods and storms. The huge crowns of the poplar trees protect the area from dust and sandstorms. Both the riparian forests and the grasslands provide habitat for many animal and plant species typical for the region. The Tarim River itself is the home of rare fish species, like the Tarim bighead carp. Last but not least, the local scenery is very beautiful.

16. [missing]

Because of extensive water use in the upper and middle reaches by farmers, industry and private households the Tarim dries out regularly in its lower reaches leading to destruction of the natural environment. The areas covered by poplar trees, shrubs and grasslands are shrinking and as a consequence many of the benefits people get from nature are lost. Most strikingly, sandstorms occur more often than in the past, destroying the harvest of farmers and the local infrastructure; the air quality is worsening because of dust; some typical plants and animal species have already become extinct; and the lower reaches of the Tarim River have been transformed into a lifeless place. Under the conditions of future climate change temperatures will increase and the Tarim River is likely to dry out completely. Then the entire area will become a desert and lost for human inhabitance.

17. [missing]

4. Tarim Environmental Preservation Plan

Scientists have developed a program with the overarching goal to improve the living conditions in the area along the Tarim River for man and nature. This program is called the **Tarim Environmental Preservation Plan** and implies a science-based water management that ensures that more and more water arrives in the lower reaches of the Tarim River, so that the riparian forests and grasslands can recover there. Once the river and its natural environment will have fully recovered, the area will be less exposed to sandstorms and dust; typical animals and plants will survive; also, the living conditions of future generations will improve.

In order to get the Tarim Environmental Preservation Plan financed, Central Government needs to transfer more money to the Tarim area. In order to finance these transfer payments government would have to increase taxes if TEPP was realized. This would lead to rising monthly expenditures for households. Economists estimate that the proposed program would increase an average Beijing household's monthly expenditures by approximately … (10 / 25 / 50 / 100 / 150 / 200) RMB.

We would like to find out whether Beijing citizens support the implementation of the Tarim Environmental Preservation Plan although it implies an increase in their monthly expenditures.

18.	Considering that your monthly household expenditures would increase by approximately … RMB through the program would you personally be willing to support it? *<u>Int:</u> Read the options*	○ (1) Yes → *go to question 20* ○ (2) No, but if the amount was lower, my household would support the TEPP → *go to question 19* ○ (3) No, my household does not tolerate any increase of its monthly expenditures in order to get the TEPP realized → *go to question 20*

19. [missing]

5. Follow-up questions

Now we would like to ask you some more questions regarding your general, personal opinion about the Tarim Environmental Preservation Plan and the environment in general. We would like to know how much you agree or disagree with the following statements.

20.		(1) Strongly disagree	(2) Disagree	(3) Unsure	(4) Agree	(5) Strongly agree
20.1.	Poor households should not have to pay for the TEPP.	○	○	○	○	○
20.2.	Not households, but central government alone should pay for the TEPP.	○	○	○	○	○
20.3.	Taxes are already so high that increasing taxes is not a good way to finance the program.	○	○	○	○	○
20.4.	Environmental conditions in the Tarim area will improve through the TEPP.	○	○	○	○	○

You just said that you would / would not accept an increase of your monthly expenditure in order to get the TEPP implemented. Before making this decision, did you consider any of these points?

21.		(1) Yes	(0) No
21.1.	Did you consider whether your household can afford to pay higher taxes?	○	○
21.2.	Did you consider other things that you could buy for … RMB?	○	○
21.3.	Did you consider your chances of visiting the Tarim area some day in the future?	○	○
21.4.	Did you consider the TEPP's positive effects on the living conditions of local people?	○	○
21.5.	Did you consider the TEPP's positive effects for future generations?	○	○
21.6.	Did you consider the TEPP's positive effects for plants and animals?	○	○

For scientific purposes we would like to ask you some questions concerning the financial situation of your household.

22. [missing]
23. [missing]

24.	What is the monthly disposable income of your household altogether? Please state total income minus income tax, personal contribution to social security. Your statement will be treated confidentially! Int: *hand over income card*	○ (1) <1000 元 ○ (2) 1000 – 1999 元 ○ (3) 2000 – 3999 元 ○ (4) 4000 – 5999 元 ○ (5) 6000 – 7999 元 ○ (6) 8000 – 9999 元 ○ (7) 10 000 – 13 999 元 ○ (8) 14 000 – 19 999 元 ○ (9) 20 000 – 29 999 元 ○ (10) 30 000 – 39 999 元 ○ (11) >40 000 元
25.	Do you regularly save money?	○ (1) Yes ○ (0) No → go to 28
26.	Concerning your saving habit, which description fits? *Int.: Read out all options.*	○ (1) I save as much as possible ○ (2) I save a fixed amount each month/year ○ (3) I usually save the money that is left over at the end of a month/year ○ (4) Other saving strategy
27.	Why do you save money? How are you going to spend your savings? *Int.: Don't read out the options. Multiple choices.*	○ (1) Don't know ○ (2) As a general precaution ○ (3) To buy expensive goods (real estate, a car, etc.) ○ (4) For child(ren)'s (education, wedding, etc.) ○ (5) To support and take care of elders ○ (6) For own retirement ○ (7) For health care expenditure ○ (8) Other
28.	How well would you say your household is managing financially these days? *Int.: Read out all options.*	○ (5) Really good ○ (4) Doing mostly good ○ (3) Just getting by ○ (2) Finding it difficult ○ (1) Finding it very difficult

29. [missing]
30. [missing]

The following questions are unrelated to the environmental problems in the Tarim area, but very valuable for our research. We would like to ask you some questions regarding your attitudes when spending money on yourself and others. How true are the following statements?

31.		(1) Completely wrong	(2) Predominantly wrong	(3) Partly wrong, partly true	(4) Predominantly true	(5) Completely true
31.1.	I often have difficulty to bring myself to spend money, regardless of the amount.	○	○	○	○	○
31.2.	In making any purchase, for any purpose, spending money is painful for me.	○	○	○	○	○
31.3.	I often spend money, even foolishly, on others but grudgingly on myself.	○	○	○	○	○
31.4.	I am very generous with people I love.	○	○	○	○	○
31.5.	I get a good feeling from contributing money to all kinds of good causes.	○	○	○	○	○
31.6.	I often say 'I can't afford it' whether I can or not.	○	○	○	○	○
31.7.	Even when I have enough money I often feel guilty if I spend money on necessities.	○	○	○	○	○
31.8.	I feel compelled to argue or bargain about the cost of almost everything I buy.	○	○	○	○	○
31.9.	Money should be saved not spent.	○	○	○	○	○

32. – 41. [missing]

6. Questions for the interviewer

How true are the following statements regarding the respondent's behavior?

42.		(1) Completely wrong	(2) Predominantly wrong	(3) Partly wrong, partly true	(4) Predominantly true	(5) Completely true
42.1.	The respondent listened carefully to the information on the Tarim area	○	○	○	○	○
42.2.	The respondent took the interview very seriously.	○	○	○	○	○
42.3.	The respondent was highly motivated during the interview.	○	○	○	○	○
42.4.	The respondent wanted to end the interview as fast as possible.	○	○	○	○	○
42.5.	The respondent got angry when asked whether his family would support the TEPP financially.	○	○	○	○	○
42.6.	The respondent said that the questions related to the TEPP were not his business.	○	○	○	○	○

8.3 Description of variables used in the regression models

Table 8-5: Variable description

Variable	Description	Mean	Std. dev.	Min.	Max.	N
AFFORD	'Did you consider whether your household can afford to pay higher taxes?' (1=yes, 0=no)	0.551	0.498	0	1	1068
AGE	Age of the respondent	38.92	14.70	18	84	1070
BID	Bid amount	89.01	68.54	10	200	1070
EDUCATION	Level of education of the respondent (1=did not graduate from primary school, 7=master degree or higher)	4.417	1.336	1	7	1070
FINMGMT	'How well would you say your household is managing financially these days?' (1=finding it very difficult, 5=really good)	3.136	0.871	1	5	1064
GENEROUS	'I am very generous with people I love.' (1=completely wrong, 5=completely true)	4.238	0.876	1	5	1057
HHSIZE	Number of persons living in the respondent's household	2.912	1.404	1	9	1070
INCOME	Monthly disposable household income in 1,000 RMB	8.871	8.294	1	50	1070
MALE	Gender of the respondent (1=male, 0=female)	0.519	0.500	0	1	1070
MONEYATT	Score on modified money attitude scale, e.g. 'Even when I have enough money I often feel guilty if I spend money on necessities' (1=completely wrong, 5=completely true)	2.678	0.918	1	5	1070
MONEYATT2	Score on the shortened variant of the modified money attitude scale (1=completely wrong, 5=completely true)	2.707	0.925	1	5	1070
MOTIV1	'The respondent took the interview very seriously' (1=completely wrong, 5=completely true)	4.225	0.757	2	5	1064
MOTIV2	'The respondent got angry when asked whether his family would support the TEPP financially'	1.761	0.880	1	5	1064
MOTIV3	'The respondent said that the questions related to the TEPP were not his business'	2.005	0.991	1	5	1064
NODOUBT	'Environmental conditions in the Tarim area will improve through the TEPP' (1=strongly disagree, 5=strongly agree)	4.149	0.987	1	5	1066
NONUSE	Number of non-use aspects considered (0=none, 0.25=one out of four aspects, (…) 1=all four aspects)	0.498	0.351	0	1	1070

Variable	Description	Mean	Std. dev.	Min.	Max.	N
AV	'Did you consider the TEPP's positive effects on the living conditions of local people?' (1=yes, 0=no)	0.440	0.497	0	1	1070
BV	'Did you consider the TEPP's positive effects for future generations?' (1=yes, 0=no)	0.620	0.486	0	1	1070
EV	'Did you consider the TEPP's positive effects for plants and animals?' (1=yes, 0=no)	0.530	0.499	0	1	1070
OV	'Did you consider your chances of visiting the Tarim area some day in the future?' (1=yes, 0=no)	0.404	0.491	0	1	1070
OPPCOST	'Did you consider other things that you could buy for … RMB?' (1=yes, 0=no)	0.421	0.494	0	1	1070
PROTEST	Average level of agreement with PROTEST1, PROTEST2 and PROTEST3 (1=strongly disagree, 5=strongly agree)	3.989	0.836	1	5	1070
PROTEST1	'Poor households should not have to pay for the TEPP'	3.840	1.264	1	5	1070
PROTEST2	'Not households, but central government should pay for the TEPP'	4.090	1.123	1	5	1070
PROTEST3	'Taxes are already so high that increasing taxes is not a good way to finance the program'	4.037	1.113	1	5	1070
SAVE	The respondent regularly saves money (1=yes, 0=no)	0.614	0.487	0	1	1070
SAVE_STRAT	Categorical variable for a respondent's saving strategy	1.571	1.429	0	4	1067
BASE	The respondent does not regularly save money (0)	0.381				
SAVE_AMAP	'I save as much as possible' (1)	0.113				
SAVE_FIXEDA	'I save a fixed amount each month' (2)	0.127				
SAVE_RESIDUAL	'I usually save the money that is left over at the end of a month/year' (3)	0.310				
SAVE_OTHER	Other saving strategy (4)	0.068				
TREAT	Experimental treatment (1=treatment group, 0=control group)	0.522	0.500	0	1	1070
WARMGLOW	'I get a good feeling from contributing money to all kinds of good causes' (1=completely wrong, 5=completely true)	3.347	1.125	1	5	1053
WTP1	Agreement with WTP question (1=yes, 0=no)	0.530	0.499	0	1	1068
WTP2	Positive WTP (1=yes, 0=no)	0.751	0.433	0	1	1068

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Eidesstattliche Versicherung

gemäß § 8 Absatz 2 Buchstabe b) der Promotionsordnung der Universität Hohenheim zum Dr.oec. und Dr. rer. soc.

Belehrung

Die Universität Hohenheim verlangt eine Eidesstattliche Versicherung über die Eigenständigkeit der erbrachten wissenschaftlichen Leistungen, um sich glaubhaft zu versichern, dass der Promovierende die wissenschaftlichen Leistungen eigenständig erbracht hat.

Weil der Gesetzgeber der Eidesstattlichen Versicherung eine besondere Bedeutung beimisst und sie erhebliche Folgen haben kann, hat der Gesetzgeber die Abgabe einer falschen eidesstattlichen Versicherung unter Strafe gestellt. Bei vorsätzlicher (also wissentlicher) Abgabe einer falschen Erklärung droht eine Freiheitsstrafe bis zu drei Jahren oder eine Geldstrafe.

Eine fahrlässige Abgabe (also Abgabe, obwohl Sie hätten erkennen müssen, dass die Erklärung nicht den Tatsachen entspricht) kann eine Freiheitsstrafe bis zu einem Jahr oder eine Geldstrafe nach sich ziehen.

Die entsprechenden Strafvorschriften sind in § 156 StGB (falsche Versicherung an Eides Statt) und in § 161 StGB (Fahrlässiger Falscheid, fahrlässige falsche Versicherung an Eides Statt) wiedergegeben.

<u>§ 156 StGB: Falsche Versicherung an Eides Statt</u>

Wer vor einer zur Abnahme einer Versicherung an Eides Statt zuständigen Behörde eine solche Versicherung falsch abgibt oder unter Berufung auf eine solche Versicherung falsch aussagt, wird mit Freiheitsstrafe bis zu drei Jahren oder mit Geldstrafe bestraft.

<u>§ 161 StGB: Fahrlässiger Falscheid, fahrlässige falsche Versicherung an Eides Statt:</u>

Absatz 1: Wenn eine der in den §§ 154 und 156 bezeichneten Handlungen aus Fahrlässigkeit begangen worden ist, so tritt Freiheitsstrafe bis zu einem Jahr oder Geldstrafe ein.

Absatz 2: Straflosigkeit tritt ein, wenn der Täter die falsche Angabe rechtzeitig berichtigt. Die Vorschriften des § 158 Absätze 2 und 3 gelten entsprechend.

Ich habe die Belehrung zur Eidesstattlichen Versicherung zur Kenntnis genommen.

Stuttgart, 27. Juli 2015_____

Ort, Datum Unterschrift

Eidesstattliche Versicherung

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

   „Contingent Valuation and Money Attitudes"

   handelt es sich um meine eigenständig erbrachte Leistung.

2. Ich habe nur die angegebenen Quellen und Hilfsmittel benutzt und mich keiner unzulässigen Hilfe Dritter bedient. Insbesondere habe ich wörtlich oder sinngemäß aus anderen Werken übernommene Inhalte als solche kenntlich gemacht.

3. Ich habe nicht die Hilfe einer kommerziellen Promotionsvermittlung oder -beratung in Anspruch genommen.

4. Die Bedeutung der eidesstattlichen Versicherung und der strafrechtlichen Folgen einer unrichtigen oder unvollständigen eidesstattlichen Versicherung sind mir bekannt.

Die Richtigkeit der vorstehenden Erklärung bestätige ich. Ich versichere an Eides Statt, dass ich nach bestem Wissen die reine Wahrheit erklärt und nichts verschwiegen habe.

Stuttgart, 27. Juli 2015

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Lebenslauf

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Publikationen

Ahlheim, M., Frör, O., Luo, J., Pelz, S., & Jiang, T. (2015). Towards a Comprehensive Valuation of Water Management Projects When Data Availability Is Incomplete - The Use of Benefit Transfer Techniques. Water, 7(5), 2472-2493.

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