ECONOMIC VALUATION, VALUES AND CONTINGENT METHOD: AN OVERVIEW

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Abstract:
In this paper the concept of total economic value of an environmental asset is introduced. The different valuation methods, putting a monetary value on environmental resources as a nonmarket good are also reviewed. Particular emphasis is placed on policy-making and the link of contingent valuation method to standard economic theory. Potential measurement bias attached to the contingent valuation estimates are also reviewed, addressed in terms of an efficient survey design and alternative microeconomic formulations.

1. Introduction

Urban planning is a complex force field with a multiplicity of actors, a variety of – often conflicting – interests, and a great deal of site-specific circumstances or features. In the history of urban planning various methodological strands have emerged, such as purely economic perspectives (reflected inter alia in urban land rent theories or social cost-benefit analyses), ecological perspectives (dealing with historical driving forces of the city), evolutionary perspectives (considering the city as a dynamic and self-organizing entity), or interactive-democratic perspectives (emphasising the city as a joint workshop with distinct responsibilities of urban agents). In recent years we have witnessed the emergence of a new paradigm for urban planning, viz. the microcosmic perspective, in which individual actors represent part of the urban interest and shape together the urban future. The methodological challenge is then to design a toolbox through which mutually complementary and mutually contrasting interests can be integrated in a decision support method that helps to identify a common pathway for the urban future.

From an economic perspective, one might argue that the city makes up a local market which is able to shape its own pathway as the result of 'invisible hand' forces. This would certainly justify a case for a non-interventionist policy, provided all conditions for market equilibrium in the city would be fulfilled. However, the city is a complex spatial entity characterized by a great deal of positive and negative externalities. The positive externalities emerge from the economies of spatial density such as scale and agglomeration advantages. The negative externalities are related to the decay in urban quality of life (e.g., congestion, criminality, socio-economic equality). Such externalities can be analyzed at the meso level of urban or local economies, but are essentiality related to micro decisions of individual actors. How do urban citizens value their environment? Which information is needed by urban planners to design a pleasant quality of life? A micro-cosmic approach may be helpful in mapping out the environmental wishes and the willingness-to-pay of urban actors. Seen from the perspective or urban quality of life, the present paper resorts to lessons from environmental economics, in particular modern evaluation techniques which have proven to offer a new analytical angle for studying the complex

relationship between urban actors and their environment, not only the social costs but also the benefits of an urban mode of living.

Conceptually, the total economic value of benefits of an urban mode of living consists of use and nonuse values. The monetary value assessment of the total economic value of an urban mode of living requires the use of special valuation tools. We pay special attention to non-market valuation, i.e., on how to place a monetary value on benefits, such as urban environmental quality, that are not routinely traded in regular marketplaces. Contingent valuation method (CVM) is one of the valuations tools suggested in the literature and this method will be the focus of our analysis.

This paper is organized as follows. Section 2 presents the concept of total economic value of an environmental asset, such as the protection of a green urban area, reviewing the different valuation methods available to put a monetary value on environmental resources as a nonmarket good. Section 3 focuses on the contingent valuation method and its importance to policy makers since it is the only valuation method that is capable to assess the nonuse value component of environmental resources. Section 4 presents the link of contingent valuation method to standard economic theory. Section 5 discusses the application of the contingent valuation and respective state-of-art research work guidelines. Section 6 reviews potential measurement bias that the contingent valuation estimates are likely to embed and how these can be addressed in terms of an efficient survey design and alternative microeconomic formulations that underpin consumer behaviour. Section 7 concludes with some retrospective remarks.

2. Economic Values and Valuation Methods

2.1 Introduction

The concept of total economic value of an environmental benefit has its foundations in welfare economics: the basic premise of economic valuation is its effect on the well-being of the individuals who make up the society. Therefore, if society wishes to make the most in terms of individuals' well-being maximisation, the issue of the monetary assessment of the total economic value of an environmental benefit is a key issue in terms of policy decisions. Conceptually, the total economic value of an environmental benefit, such as the protection of an urban green area, consists of its use value and nonuse value – see Table 1.

Table 1. Classification of benefits derived from the protection of an urban green area

Total economic value	Use	direct use value	Recreation benefits e.g. jogging, bird watching, walking (with the dog)
		indirect use value	ecosystem functional benefits e.g. carbon sequestration, timber production
		option value	safeguard of use benefits e.g. future visits
	Nonuse:	bequest value	legacy benefits e.g. conservation for the use of the future generations
		existence value	existence benefits e.g. knowledge of protection of urban green area

Use values are what they seem to be: values arising from the actual use/consumption made of the urban green area. Use values are further divided into direct use values, indirect use values and option values. Since we focus on the value assessment of the benefits derived from the protection of a green park in a urban context (the emblematic case is the Central Park in New York), the direct use value refers to the various forms of recreation possibilities available to the park's

visitors; the indirect use value refers to benefits deriving from ecosystem functions such as the park's role in terms of carbon sequestration; the option value refers essentially to the individual's willingness to pay for the preservation of the park against some (subjective) probability that the individual will make use of it at a future date. In addition, the conservation of an urban park has impacts on the well-being of the individuals that are not directly associated with recreational consumption. These are referred to in the literature as the nonuse values, i.e., anthropocentric values which are not associated with current or expected use. The nonuse values are usually divided between the bequest value and the existence value. The bequest value refers to the benefit accruing to any individual from the knowledge that others might benefit from the park in the future; the existence value refers to the benefit derived simply from the knowledge of continued protection of the urban green area. The nonuse values have typically a public good character for which no market price is available to disclose accurate monetary valuation. The lack of such market price information may convey the impression that benefits of conservation policies are unimportant, when compared to the market priced allocation alternatives (e.g. urbanisation and commercial development of the area). As a consequence, most of the time policy makers have based their decisions on an undervaluation of the environmental resources which has thus resulted in a misallocation of scarce environmental resources.

The monetary assessment of the use and nonuse benefits involved with the conservation policy is, therefore, an important step in policy decisions about environmental resources use. The money value assessment of such environmental assets requires special tools. These are discussed in the following session.

2.2 Monetary Valuation Methods

Various valuation methods are available to put an economic value on environmental benefits. We can distinguish two groups of valuation methods: the direct and indirect or dose response valuation methods - see Table 2. The dose response methods have in common that they put a price on environmental commodities without retrieving people's preferences for these commodities. The production cost techniques such as the dose response methods rely on the presence of physical input-output relationships. For example, if one is willing to estimate the monetary value of the benefits of clean air on human health, one can take into account the relationship of air pollution on the number of visits to physicians and purchase of drugs. Conversely, the direct methods rely on individual preferences. On the basis of the process by which these methods retrieve individuals' preferences, these methods are further divided into revealed preference methods and stated preference methods. The group of revealed preference valuation methods consists of three methods: travel cost, hedonic pricing and averting behaviour (see Braden and Kolstad 1991). The common underlying feature is a dependency on a relationship between a market good and the environmental benefit. For example, when using the travel cost method, researchers estimate the economic value of recreational sites by looking at the costs of the trips made by the visitors to these sites. When using the hedonic price method to estimate the economic value of clean air the researchers explore the analysis of house market prices and surrounding air characteristics. Researchers who use the averting behaviour method try to estimate the economic value of clean air on the basis of expenditures on technological equipments made to avert or mitigate the adverse effects of air pollution.

Table 2. A classification of economic valuation methods

Revealed preference	Stated preference	Dose response
Travel cost	Contingent valuation	Production cost
Hedonic pricing	Contingent ranking	Production factor
Averting behaviour	Pairwise allocation games	

Whereas economists who use revealed preference valuation methods have to carry out estimation exercises bearing in mind the existent market price data, economists who use stated preference valuation methods have to collect their own data by means of questionnaires. The underlying feature is the use of the questionnaire to ask directly the individuals to state their economic values for environmental commodities (Mitchell and Carson 1989). The use of questionnaires require economists to work closely with experts from market and survey research, sociology and psychology in order to guarantee the authority of the stated choice methods as a valid instrument to assess economic value of an environmental benefit (Carson et al. 1992, NOAA 1993). In contrast, revealed preference methods have remained an exclusive valuation tool for economists. Stated preference valuation methods: the contingent valuation, contingent ranking, pair-wise comparison and allocation games. The respective differences relate to the way in which the economic values are elicited. For example, whereas the contingent valuation method asks respondents to express directly their preferences in monetary terms for some defined environmental benefit, the contingent ranking method asks the respondent to rank a number of described environmental quality alternatives. The pair-wise comparison is closely related to the contingent ranking method, yet, respondents are asked to compare a series of pairs of alternatives. Finally, in an allocation game respondents are asked to allocate a fixed budget among a set of environmental benefits. This method is frequently used in experimental economics.

2.3 The Contingent Valuation Methodology

CVM is a stated preference valuation method that uses questionnaires to ask directly the individuals to state their preferences for environmental commodities. Mitchell and Carson defined the method as follows:

"The CVM method uses survey questions to elicit people's preferences for public goods by finding out what they are willing to pay (WTP) for specified improvements in them. The method thus aims at eliciting their WTP in dollar amounts. It circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the good in question. The hypothetical market may be modelled after either a private goods' market or a political market. Because the elicited WTP values are contingent upon the hypothetical market described to the respondents, this approach came to be called the contingent valuation method." (Mitchell and Carson 1989, pp. 2-3)

The typical CVM survey consists of three sections.

- The first section is characterized by the description of the environmental change as conveyed by the policy formulation and the description of the contingent market. The policy formulation involves describing the availability (or quality) of the environmental commodity in both the 'reference state' (usually the status quo) and 'target state' (usually depicting the policy action). Since all monetary transactions occur in a social context, it is also crucial to define the contingent market - most of the time rather unfamiliar to the respondents - by stating to the respondent both the rules specifying the conditions that would lead to policy implementation as well the payment to be exacted from the respondent's household in the event of policy implementation.
- The second section is where the respondent is asked to state her monetary valuation for the described policy formulation. This part is the core of the questionnaire. The major objective of this section is to obtain a monetary measure of the maximum willingness to pay that the individual consumers are willing to pay for the described environmental policy action.
- The third section of the CVM instrument is a set of questions that collect socio-demographic information about the respondents. The answers to these questions help to better characterise the respondent's profile and are used to understand the respondent's stated WTP responses. The third section finishes with follow-up questions. The follow-up questions are answered by the interviewers. The goal is to assess whether the respondents have (well) understood the CVM survey in general and the valuation question in particular.

Today, the CVM is one of the most used techniques for valuation of environmental benefits.

This is partly due to the advantages of CVM compared to other valuation methods.

- First, the CVM method gives immediately a monetary assessment of respondents' preferences.
- Second, the CVM method is the only valuation technique that is capable of shedding light on the monetary valuation of the nonuse values, i.e., the benefit value component of the environmental commodity that is not directly associated with its direct use or consumption. These values are characterized by having no behavioral market trace. Therefore, economists cannot glean information about these values relying on market-based valuation approaches. For environmental resources such as the protection of natural parks or biodiversity sensitive areas, which play an important role in guaranteeing the protection of local wildlife diversity, the nonuse value component may account for the major part of the conservation benefits. Ignoring such values will be responsible for a systematic bias in the estimation (an underestimation) of the total economic value of the related environmental.
- Third, CVM brings with it the advantage that environmental quality changes may be valued even if they have not yet occurred (ex ante valuation). This implies that the CVM can be a useful advisory tool for policy decision-making.
- Fourth, and as result that environmental changes may be valued even if they have not yet occurred, CVM offers a greater potential scope and flexibility than the revealed preference methods since it is possible to specify different states of nature (policy scenarios) that may even lie outside the current institutional arrangements or levels of provision. Furthermore, the constructed nature of the CVM method permits to test various methodological issues concerning the measurement validity of the individual's stated valuation responses. Indeed, a great deal of today's research efforts is concerned with the validity of CVM responses. We start, however, with a brief history of CV, exploring the link of survey valuation answers to standard economic theory.

3. A Brief History on Contingent Valuation

3.1 Introduction

The first CVM published reference dates from 1947 (Ciriacy-Wantrup 1947). We refer to the Ciriacy-Wantrup article published in the *Journal of Farms Economics*. The study focuses on the valuation of the economic effects of preventing soil erosion. The author suggested that one way to obtain information on the demand for these favourable effects would be to ask directly the individuals how much they would be willing to pay for successive increments. However, no empirical valuation was attempted. However, the first CVM design and implementation only occurs two decades later when Robert Davis assessed the economic value of the recreational possibilities of the Maine Woods by exploring the survey technique (Davis 1963). Davis simulated a market behavior situation by putting the interviewer in the *"position of a seller who elicits the highest possible bid from the users of the services being offered"*.

Since these early beginnings, the CVM has been used to measure benefits of a wide range of environmental goods including recreation, amenity value, scenery, forests, wetlands, wildlife, air and water quality. More recently, there has been a trend to conduct CVM studies not only to value environmental goods, but also to investigate the various methodological issues involved in the valuation exercise, including the study of the impact of consumer's attitudes, motivations on CVM estimates – see section 6.5. Furthermore, throughout these decades, the CVM has gone through several phases, emerging from the academy into the rough and tumble of the outside world. Strong development stimulus was given by the Reagan Executive Order 12291, introduced in 1981; the re-interpretation of CERCLA, in 1989; the Exxon Valdez damage assessment, in 1992, and, more recently, the NOAA panel.

3.2 Reagan Executive Order & the Re-interpretation of CERCLA

The Reagan Executive Order 12291, introduced in 1981, constitutes a strong stimulus for the development of the monetary valuation methods of environmental commodities. In concrete terms, the Executive Order stipulated that all federal regulations on environmental policy should be submitted to a cost-benefit analysis. All regulations, including both the promulgation of new regulations and the review of the existing ones, would only be carried out if a positive present value for the society could be achieved. Therefore, the social benefits had to be monetized. The flexibility and generality of CVM's application was the main reason why this valuation method received most of the EPA's "demands" in the monetary assessment of the social costs and benefits associated with the new regulations on environmental policy. Thus, the appearance of Executive Order 12291 had a major impact in the development of the CVM.

Another important benchmark in the CVM is the District of Columbia Court of Appeals re-interpretation in 1989 of the US Comprehensive Environmental Response, Compensation and Liability Act of 1980 (USDI 1989). This governmental decision expressed not only the legitimacy of nonuse values as a component of the total resource value, but also granted equal standing to stated and revealed preferences evaluation techniques. Since then, the CVM is being widely used by academic institutions as well as by governmental agencies as a crucial tool in cost-benefit analysis and damage cost assessment.

3.3 The Exxon Valdez Valuation Report

Another important benchmark in the history of the CVM is the massive oil spill due to the grounding of the oil tanker Exxon Valdez in the Prince William Sound in the Northern part of the Gulf of Alaska on March 24, 1989. This oil spill was the largest oil spill from a tanker in US history: more than 1,300 kilometres of coastline were affected and almost 23,000 birds were killed (Carson *et al.* 1992). After the oil spill, the State of Alaska commissioned various studies to identify the physical damage to the natural resources. The follow-up economic damage assessment studies also take into account, in addition to water purification costs, economic losses such as the decrease in revenue from recreation and fisheries. Moreover, the State of Alaska appointed an interdisciplinary group of researchers to design and implement a national CVM study to measure the loss of nonuse values to US citizens as a result of the oil spill. This study constitutes one of the major contingent valuation applications and represents an important methodological reference for all contingent valuation researchers' work. The loss of nonuse values resulting from the Exxon Valdez oil spill is estimated at 2, 8 billion dollars. However, anticipating these high financial consequences, Exxon commissioned a group of researchers to verify whether nonuse values could be accurately measured by the means of CVM. The main argument of critics of CVM is that this method is not capable of resulting in valid and reliable monetary measures of nonuse values. Hausman's well-know argument *"is some number better than no number"* fully expresses the scepticism toward the CVM method. Therefore, according to Hausman, assessments of lost nonuse values by means of the CVM method should not be used in court. In order to address Hausman's critique, National Oceanic and Atmospheric Administration set a group of experts in order to evaluate the reliability of the use of CVM in the natural resource damage assessments.

3.4 The NOAA Panel

A panel of experts, with the Nobel Laureates Kenneth Arrow and Robert Solow as chairmen, provided advice to the National Oceanic and Atmospheric Administration, NOAA, on the following question: "is the contingent valuation method capable of providing estimates of lost nonuse or existence values that are reliable enough to be used in the natural resource damage assessments?" The final advice of the NOAA panel may be summarised by the following sentence:

"... the Panel concludes that well conducted CVM studies can produce estimates reliable enough to be the starting point of a judicial process of damage assessment, including lost passive values." (NOAA, Federal Register, Vol. 58, No. 10, p. 4610)

This conclusion cheered all researchers who wish to use the contingent valuation. However, the Panel was rather prudent with its conclusion and qualified such a statement by establishing a set of guidelines, recommended to all future CVM applications, concerning the design and execution of the survey instrument. The six most important guidelines, also well known as the six pillars of the NOAA, are summarised as follows:

1. CVM should rely on face-to-face interviews rather than telephone interviews, and whenever this is not possible (specially because of the high costs associated with the personal interviews) telephone interviews are preferable to mail surveys;
2. CVM should elicit the respondent's WTP to prevent a future incident rather than WTA for an incident already occurred;
3. CVM should use a dichotomous choice referendum elicitation format, i.e., the respondents should be asked how they would vote (favour or against) upon a described environmental quality change. The main reason for the dichotomous choice is that such a take-it-or-leave-it survey valuation question is more likely to reflect real daily world market decisions which individuals are confronted with. Moreover, the dichotomous choice referendum reveals itself to be less vulnerable to strategic bidding behavior than, for example, the open ended elicitation format;
4. CVM should contain an accurate and understandable description of the program or policy under consideration and the associated environmental benefits in each of the two scenarios, i.e., with and without the policy. Interdisciplinary work with other research areas, namely the biological sciences, is here recommended;
5. CVM should include reminders of the substitutes for the commodity in question as well as its budget. In a context where the respondents are being asked how they would vote on a financial contribution to protect a natural area, the respondents should be reminded of the existence of the other areas that exist. Moreover the respondent should be reminded that such contribution would reduce the amount of money that he or she has available to spend on other things. The major idea here is to make such a (hypothetical) valuation exercise resemble as closely as possible an actual market transaction;
6. CVM experiments should include a follow-up section at the end of the questionnaire to be sure if the respondents understood (or not) the choice that they were asked to make;

According to the Panel, this set of guidelines contributes to guaranteeing the quality of the CVM survey as a measurement instrument and the validity of the respective monetary measures for cost-benefit analysis and damage cost assessments. In the following section, we show how the behavior of CVM respondents can be analysed with standard microeconomic models of choice and explore the demand for environmental quality with respect to alternative measures for assessing welfare changes.

4. Theoretical Underpinning on the Use of Contingent Valuation

4.1 Introduction

Neo-classical theory attempts to model the demand for goods given, certain assumptions. The central assumption pertains to the behavioral characteristics of the individual, i.e., the consumer. The theory assumes that consumers act rationally. This behavioral premise implies two things. First, individual consumers have coherent preferences over the different states of the world. These states can be defined so broadly that they can encompass the distribution of private goods and services, or the provision of public goods like environmental quality. Second, when making choices among alternative states of the world, the individual does this on the basis of her preferences, choosing the state that is most preferred. The underlying intuition that one can draw from the rationality premise is that if an outside observer knew the preferences of any given individual as the individual knows them, that knowledge could be used to explain the human behavior as it relates to choices. It is important, however, to see that the prior "rationality" does not mean "unbounded rationality": surely there are cognitive constraints to any respondent's ability to make complex choices such as the economic valuation of environmental changes (seldom thought in monetary terms). The important thing is that respondent answers to the CVM

questionnaire in general, and to elicitation questions in particular, in a manner consistent with the respondent's preferences.

4.2 The Basic Model

The present section draws on the theoretical perspective that individuals make welfare-optimising consumption decisions. These decisions are captured in the consumer demand functions with respect to available goods and services. Environmental attributes enter those demands. For some environmental benefits, such as the recreational visits to an urban green park, the consumer exercises direct choice over the amount consumed, assuming that the park is open to all residents. To illustrate this setting, we consider an individual, whose utility function has the following form,

$$V = V(x, q, z) \tag{1}$$

where *x* is the consumption of the private good, *q* the quantity of the environmental attribute and *z* the quality of that attribute. For example, *q* could represent the number of visits and *z* the level of protection of the urban green area. We assume that all commodities, including the number of visits, have prices. Moreover, we assume that *x* is a composite private good whose price is normalised to one, and *p* is the price associated with *q*, and that *p* is fixed. We also assume that the consumer exercises direct choice over *q* but not over *z*. The consumer maximises utility subject to a budget constraint,

$$p.q + x \leq M \tag{2}$$

where *M* is money income. Assume non-satiation, i.e. that the consumer uses the available budget fully. For a particular level of *M* and *z*, the consumer solves,

$$\underset{\{x,q\}}{Max}\ V(x, q, z) \tag{3}$$

$$s.t.$$

$$p.q + x = M$$

$$q, x \geq 0$$

yielding some level of utility, *V**, and an optimal consumption bundle, *(q*,x*)*, both of which are functions of *p*, *M* and *z*. To investigate a change in *z*, holding utility constant, we proceed to the total differentiation of $V(x^*, q^*, z)$ and $p.q^* + x^* = M$. Formally, we have:

$$dV = \frac{\partial V}{\partial q} dq + \frac{\partial V}{\partial z} dz + \frac{\partial V}{\partial x} dx \tag{4}$$

and

$$dM = qdp + pdq + dx \tag{5}$$

We focus how changes in *q* and *z* can be compensated by changes in *M*. Thus, we let *dV=0*. The assumption of fixed prices means that *dp=0,* so the first term in (5) drops out. Rearranging (4)-(5), we get:

$$-dx = \frac{\partial V/\partial q}{\partial V/\partial x} dq + \frac{\partial V/\partial z}{\partial V/\partial x} dz \tag{6}$$

and

$$-dx = pdq - dM \tag{7}$$

Now let *z* be the attribute for which a change is contemplated. Setting equal the right-hand sides of the expressions (6)-(7) gives,

$$\frac{\partial V/\partial q}{\partial V/\partial x}dq + \frac{\partial V/\partial z}{\partial V/\partial x}dz - pdq = -dM \tag{8}$$

Equation (8) establishes that the monetary payment must equal the difference between the personal worth of the change in quantity and quality, the first two terms on the left-hand-side, and the change in the expenditure on *q*, the last term on the left-hand-side. A fundamental condition in consumer theory is that the consumers that make welfare-optimising consumption decisions equate the marginal rate of substitution to the ratio of product prices. In the present case, *p* is normalised with respect to the price of composite commodity *x*:

$$\frac{\partial V/\partial q}{\partial V/\partial x} = p \tag{9}$$

Substituting (9) into (8) and cancelling the terms results in:

$$\frac{\partial V/\partial z}{\partial V/\partial x} = -\frac{dM}{dz} \tag{10}$$

i.e., the marginal rate of substitution between *z* and *x* must equal the change in income that will keep utility constant as *z* changes, which can be interpreted as the introduction of a set of new regulations on the protection of the green natural park (e.g. stricter regulations on the use of the park and banning the use of scoters inside the park). That income change is the "price" that reflects the consumer's maximum willingness to pay (WTP) to avoid an undesirable change in *z*. In other words, the theoretical economic measure of welfare change, as described by (10), is the payment that will make a consumer indifferent between having and not having a particular change in the quality or quantity of the environmental attribute. This is the measure of welfare change that CVM researchers look for through the use of direct questioning.

4.3 Alternative Measures of Welfare Change

The literature suggests two alternative measures that can be used to assess the magnitude of the welfare change as described by (10), respectively the Hicksian compensating measure and the Hicksian equivalent measure, are theoretical refinements of the ordinary consumer's surplus (Hicks 1943). Before introducing the Hicksian compensating and the Hicksian equivalent as alternative welfare measures of welfare change, we return to the model as presented in the last section and investigate the welfare change associated with a non-marginal decrease in the quality level of the environmental attribute, *z*. This environmental change may be interpreted as the introduction of a set of new regulations designed to allow partial commercial development of the urban green area, zoning areas for bars and restaurants where before did not exist. In the original situation, i.e., before the setting of the new regulations policy, the individual consumer faces a particular quality level of the environmental attribute; denote such level by z^0. For an environmental quality level z^0, and given an amount *M* of monetary income, the consumer solves (1.3) yielding an optimal consumption bundle $\left(q^0, x^0\right)$ and the utility level $V^0 = V\left(q^0, x^0, z^0\right)$. Inserting the demand functions into the utility function gives the indirect utility function $V\left(q^0\left(p, M, z^0\right), x^0\left(p, M, z^0\right), z^0\right) = v\left(p, M, z^0\right)$. Inverting the indirect utility function for the term *M* yields the expenditure function on market goods required to produce utility level *V*, given *p* and z^0. This is $e\left(p, z^0, V^0\right)$. Table 3 summarises the notation.

This welfare measure equals the compensating payment, i.e., an offsetting change in income, necessary to make the individual indifferent between the original situation (status quo) and the new environmental regulation policy (after the environmental quality change). In terms of the indirect utility function, the Hicksian compensating variation (HC) is the solution to

$$v\left(p, M, z^0\right) = v\left(p, M + HC, z^1\right) = V^0 \tag{11}$$

i.e., the HC measures what must be paid to the individual to make that person indifferent to the new environmental quality level. In other words, if the new regulation is adopted, the individual's income could be increased by the amount of HC and that person would still be as well off as in the original situation. Alternatively, HC can also be defined in terms of the expenditure function. In terms of the expenditure function, HC is the difference between the expenditures required to sustain utility level V^0 at the new environmental quality level, i.e.

$$HC = e\left(p, z^1, V^0\right) - e\left(p, z^0, V^0\right) = e\left(p, z^1, V^0\right) - M \tag{12}$$

Since spending *M* at the new environmental attribute quality level yields a lower level of utility, i.e. V^1, we can also write

$$M = e\left(p, z^1, V^1\right) \tag{13}$$

and by substitution

$$HC = e\left(p, z^1, V^0\right) - e\left(p, z^1, V^1\right) \tag{14}$$

i.e., although the HC is defined in terms of V^0, it also measures the amount of money required to raise the utility from V^1 to V^0 at the new quality level of the environmental attribute.

Table 3. Summary of results

Variables	Original situation	New regulation (introduction of bars and restaurants)
Environmental attribute quality	z^0	z^1
Utility level	V^0	V^1 with $V^0 > V^1$
Indirect utility function	$v\left(p, M, z^0\right)$	$v\left(p, M, z^1\right)$
Expenditure function	$e\left(p, z^0, V^0\right)$	$e\left(p, z^1, V^1\right)$

The Hicksian equivalent measures the change in income (given the original quality level) would lead to the same utility change as the change in the quality of the environmental attribute. In terms of the indirect utility function, the Hicksian equivalent (HE) is the solution to

$$v\left(p, M, z^1\right) = v\left(p, M - HE, z^0\right) = V^1 \tag{15}$$

i.e., the HE measures the income change equivalent to the welfare lost due to the decrease in the quality of the environmental attribute. In other words, and if we admit that the implied property rights are assigned to the change and not to the status quo, the HE translates the maximum amount that the individual would be willing to pay to avoid the changes in the quality level of the environmental attribute. The HE can also be defined in terms of the expenditure function. It is the difference between the expenditures required to sustain utility level V^1, at the original environmental quality level:

$$HE = e\left(p, z^0, V^0\right) - e\left(p, z^0, V^1\right) = M - e\left(p, z^0, V^1\right) \tag{16}$$

Substituting (13) into (16), we get

$$HE = e\left(p, z^1, V^1\right) - e\left(p, z^0, V^1\right) \tag{17}$$

i.e., although the HE is defined in terms of the monetary equivalent of a change from V^1 to V^0, it can also be measured by the change in the expenditure function associated with the environmental quality changes (given the utility level V^1).

These two Hicksian welfare measures can also be interpreted in terms of the implicit rights and obligations associated with alternative environmental quality levels. The HC carries with it implicitly the assumption that the individual has the right to the original environmental quality level in case of environmental quality deterioration. In contrast, the HE contains the assumption that the individual has an obligation to accept the decrease in the quality in the environmental attribute and thus will have to make a payment if the new quality level is not to be attained. Based on the interpretation of the two measures, we are able to argue that the choice between them is, basically, an ethical one, i.e., one that depends on the value judgement as to which underlying distribution of property rights is more equitable (Krutilla, 1967). The results can be summarised as follows:

Table 4. Welfare measures and the property rights distribution

Attribute quality	Hicksian Equivalent measure: Implied property rights in the change	Hicksian Compensating measure: Implied property rights in the status quo
Increase	WAC to forgo	WTP to obtain
Decrease	WTP to avoid[1]	WAC to accept

[1]The preferred welfare measure according to the suggestions of the NOAA panel (1993)

5. Contingent Valuation in Practice

5.1 Introduction

In 'standard' private market exchanges, an individual evaluates the alternative market prospects given her previous experience and market information. The nature of the CVM application, in terms of policy choice appraisal, makes the value formulation problem more difficult relative to ordinary market decisions (Mitchell and Carson 1993).

- First, in CVM, an individual formulates a valuation given the experience and the information provided by the contingent market, i.e., as described in the survey instrument.
- Second, CVM is usually applied to assess the monetary valuation of alternative protection choices that, most of the times are unfamiliar to the citizens. However, these are precisely the cases where the lack of public information for policy choice is the greatest.
- Third, the time devoted to contingent choices may be more limited than in market situations. This time constraint occurs for two reasons: (a) the research strategy may seek to reduce data collection costs by limiting the time devoted to gathering each set of observations; (b) the respondent may choose to limit her time resources devoted to value formulation. Therefore, the value formulation process in the contingent market is submitted to sources of error. Information errors may arise as complex information is communicated to the respondents. Information errors may be left uncorrected due to time constraints on review or repetition. Thus the time constrained process of

communicating complex information is an important source of error in the value formulation process.

The question is then: what is the level of information necessary to be provided in the survey instrument? How much information should be provided in a CVM questionnaire so that the respondents are able to make a valid value formulation? These questions are addressed in the following sections.

5.2 Definition of the Survey Contingent Market

The description of the contingent market is very important in guaranteeing a successful valuation exercise and, this way, can produce estimation results that can be interpreted in economic terms (Carson et al. 1999, Nunes 2002). The description of the contingent market involves three major design tasks. The CVM researcher has in one first stage to (1) identify the set of environmental attributes to which the policy formulation is addressed and measure the respective levels in each of the 'reference' and 'target' states; then (2) describe the social context that involves the hypothetical transaction; and finally (3) recognize the circumstances under which the environmental change is made available to the respondents.

- In the first stage, which concerns the identification and measurement of the set of environmental attributes, it is crucial to work together in a multidisciplinary team, making the best use of the scientific information available. This work goes usually hand-in-hand with the use of focus groups, i.e., small groups of citizens, from all educational levels and varied life experiences, which are invited to discuss the degree of understanding of the material proposed to be used in the description of the public policy. Their comprehension feedback is crucial since it is very important that all the individuals potentially affected by the change in public policy are able to understand the described contingent market. Therefore, careful wording has to be provided without making the questionnaire so complex that its understanding would be beyond the ability, or interest, of many respondents. Finally, the CVM survey communicates the policy formulation as much as possible in visual form, making use of photos, images and computer manipulated images: this makes it possible to the respondent to better "visualise" the range of changes involved.
- In a second stage, the CVM researcher has to choose the payment mechanism and the number of the years involved in the transaction. This means that the respondent has to be informed both about the way in which the described environmental changes are financed and about the number of years over which payments are collected. The best recommendation is to choose a plausible payment vehicle, i.e., one that is perceived as a likely way to pay the environmental change. This improves the credibility of the contingent market: if the respondent finds the payment vehicle believable, ceteris paribus, she takes the choice situation more seriously.
- Finally, the respondent has to be informed how the survey results are likely to be used. This involves describing to the respondent the capacity of the government in providing the described environmental service(s) as well as the ability of the government to (coercively) collect the payment for the described environmental service(s). The underlying idea is to make the respondents taking care about the policy outcomes described in the survey instrument as well as to make the respondents perceiving that their responses to the survey as potentially influencing the final outcome(s).

5.3. The Level of Survey Information

On one hand, enough information must be provided to enable the respondents to make sound choices (Fischhoff and Furby 1988). Naturally, it is easier to make a valuation of a 'red car' if information is also available about the brand, its age, mileage, and so on, than to make a valuation of a 'red car' without such additional information. Most probably, one could expect that such "variations" in the information set are associated with different value estimates. Empirical evidence from CVM studies supports this assertion. Samples et al. (1986) tested the proposition that an individual's reported WTP to preserve a particular species would be significantly influenced by information about the species and its endangered status. The test results confirmed

that the estimated values of wildlife conservation were indeed dependent on the level of information conveyed. Hanley et al. (1995) found that the WTP to preserve biodiversity increases significantly as the level of information provision increases, but at a decreasing rate - "*what is out of sight, is out of mind"* (Tversky and Kahneman 1973, Woo 1996). But, on the other hand, the need for information must be balanced with the need to keep surveys to a reasonable length and easily comprehensible. If enough information is required to communicate alternative policy formulations that, most of the times are unfamiliar to the citizens, too much information will drive the respondent's attention away. The challenge is, therefore, to reach an appropriate level of information. This involves two tasks: an accurate description of the environmental changes associated with the proposed policy formulation as well as an accurate description of the contingent market.

5.4 Survey Elicitation Question

Once the respondent is given the description of the environmental change(s) and the contingent market involving such a provision, the respondent is asked to report her monetary valuation. This involves the choice of the informational support in which the respondent is able to report her valuation responses, i.e., the choice of the elicitation question format. We review five elicitation formats, respecting more or less a chronological order, and discuss the various pros and cons associated with each of these methods - see Table 5.

One the earliest elicitation formats was developed by Davis (1963) and is called the 'bidding game'. The bidding game format was also applied by CVM studies in the 70s (for example, Randall et al. 1974, Brookshire et al. 1976). The assumption is that the individual's WTP will be obtained after a series of questions has been asked, i.e., letting the interviewer iteratively raise, or lower, the proposed bid until the respondent alters her yes or no answer. A fine-tuning of the bidding game format may be achieved by rising, or lowering the bids in the reverse direction after a change in the "yes/no" answers. An advantage of the bidding game is that respondents get some assistance to arrive at a WTP value; moreover, the choice process of the respondent is simplified, so that the number of non-responses may be reduced. These desirable features are, however, obtained at high costs. The principal disadvantage is the phenomenon of 'anchoring' or 'starting-point-bias' (Mitchell and Carson 1989). This occurs when the respondent sees the initial bid as a clue, or reference point, for her final valuation. Thus the respondents who start with a lower initial bid will end up, ceteris paribus, with a lower WTP than the ones who start with a higher bid. To make matters worse, the bidding game format is highly vulnerable to a 'yea-saying', i.e., the fact that respondents tend to agree with increasing bids regardless of their true valuations (Kanninen, 1995). Consequently, the bidding game may be expected to result in an overestimation of the environmental change. Finally, the respondents become bored during the bidding game, especially if the iterative process is particularly long, meaning that their motivation will decline, so that the respective answers will be less accurate. The open-ended, or direct questioning, format consists of one single question that straightforwardly asks for the maximum amount that the respondent is willing to pay for the described environmental change: "What is the maximum amount of money that you are willing to pay for (…)". The main advantage of this format is that it immediately gives the information that the researcher is looking for. However, this method opens up the possibility of some form of strategic behavior: many respondents may immediately state zero WTP although the amenity has value for them, simply because the respondent may attempt to misreport her preferences by bidding untruthfully and thus affecting the outcome (Hoehn and Randall 1987). That is to say, there is a possibility that the respondents will reveal a WTP that is biased downward in the hope of getting "something for nothing". The reluctance of individuals to contribute to the support of public goods is a well-known phenomenon in the literature and referred to as the free rider problem. Furthermore, the open ended question may be very difficult to answer for the individual because most of the time the described environmental change is not particularly familiar to her (Hoevenagel 1994). In this context, Mitchell and Carson argue that "respondents often find it difficult to pick up a value out of the air, as it were, without some form of assistance" (Mitchell and Carson 1989, p. 97). Finally, individual consumers are not used to this procedure in normal market behavior; generally speaking, consumers make choices about buying (or not) a given good at fixed market prices.

Table 5. Comparative analysis of alternative elicitation formats

	Advantages	Disadvantages
Bidding game	Simple and assisted iterative process High participation rate	Anchoring Yea-saying Boring
Open ended	Displays the WTP in the format that the research is looking for Higher accuracy of the relevant statistics	Low participation rates Vulnerable to strategic behavior No valuation 'assistance' Procedure not familiar to consumers
Payment card	No anchoring Displays the WTP in the format that the research is looking for	Limited range of the cards Vulnerable to strategic behaviour
Dichotomous choice	Simple and assisted iterative process High participation rate No anchoring Incentive compatible Procedure familiar to consumers	Yea-saying Too expensive Low accuracy of the relevant statistics
Dichotomous choice with follow-up	Simple and assisted iterative process High participation rate No anchoring Incentive compatible Procedure familiar to consumers Higher accuracy of the relevant statistics	Yea-saying Too expensive Complexity of the involved estimation procedures

The payment card was developed as a response to the large proportions of non-responses and protest 'zeros' which were obtained in the CVM applications with open-ended formats (Mitchell and Carson 1989). The payment card format means that the respondents are offered a card that contains a list of bid amounts. Then the respondents are asked to indicate which amount of money on the card they are willing to pay for the described environmental change. According to Mitchell and Carson the payment card would give the respondents some assistance in searching for their valuation. Furthermore, it would avoid the phenomenon of start bid 'anchoring', as described in the bidding game, and still maintain the positive feature of the open-ended format, i.e., measure the respondent's WTP by mean of a single question. However, the validity of the stated WTP amounts may be questioned because the range of the payment card, specially the maximum bid amount, may influence the final WTP answers of the respondents (Hoevenagel 1994). From an economic point of view, the range of the payment card should be irrelevant: the different maximum amounts on the payment card do not reduce the set of choices of the respondents because each card contains the category 'other, namely: (…)'.

The dichotomous choice referendum format, also known as the take-it-or-leave-it (TIOLI) approach, asks the respondents how would they vote (in favour or against) upon a described program (and associate environmental benefits) upon the payment of an individual cost which is specified in the question format (e.g. *"Is your household willing to pay $xx for …"*). The main reason for the dichotomous choice is that such TIOLI valuation question is more likely to reflect real daily world market decisions which individuals are confronted with, rather than, for example, when respondents are facing an open ended question. Technically speaking, the dichotomous choice elicitation format is simply the first round of the bidding game: the respondents are asked to accept or reject a specific bid amount in return for an environmental change. Therefore, one of the properties of the bidding game is kept: it burdens the respondent less than the open-ended question formats. This elicitation format also avoids most of the disadvantages of the bidding game. Firstly, the dichotomous choice elicitation uses various bid amounts and randomly assigns them to the respondents thus minimising the 'starting-point' phenomenon. Secondly, this

elicitation format has the characteristic of being incentive compatible, i.e., truth telling is the individually optimal strategy (Hoehn and Randall 1987). Nevertheless, when compared to the elicitation question formats mentioned above, the dichotomous choice format involves a stronger financial effort in interviewing since it requires substantially larger samples to obtain the same degree of accuracy of the relevant statistics and thus the same level of value estimation precision. The dichotomous choice format may also encourage the "yea saying" phenomenon where the posted bid is accepted as a hint of what is a reasonable payment (Kanninen 1995).

The dichotomous choice with one follow-up elicitation format, also called the double-bounded dichotomous choice, was first proposed in 1986 (Carson et al. 1986) and is an extension of the (single-bounded) dichotomous choice format. This elicitation format involves the simple addition of one extra dichotomous choice question, containing a proposal for a bid that is dependent on the first bid. So, if the respondent answers "yes" ("no") to the initial bid, then the bid amount, proposed in the second question, is increased (decreased). As in the single-bounded dichotomous choice, a nice property of this elicitation format is that the empirical survival function can be estimated from which the mean and median can be assessed (Cameron 1988, Kriström 1990, Cameron and Quiggin 1994). It has also been proved that the follow-up greatly improves the statistical efficiency of the dichotomous choice format (Hanemann et al. 1991). This means that for each observation, i.e. for each respondent, the CVM researcher has more information about the "location" of the respondent's WTP. In econometric terms, this additional information is reflected (1) in a higher precision in the estimation of the truncated intervals of the c.d.f. and (2) more robust valuation estimates. In other words, this means that it is possible to get more precise WTP value estimates with the same sample dimension and thus, without incurring additional interviewing costs.

6. Respondent's Strategic Behaviour and Value Measurement Bias

6.1 Introduction

The CVM researchers, borrowing from Samuelson's notion of "false signals" maintain a priori that different payment scheme provides different incentives for engaging in strategic behaviour and thus influencing the expected valuation results. As Samuelson argued *"It is in the selfish interest of each person to give false signals to pretend to have less interest in a given collective activity than she really has."* (Samuelson, 1954, p. 388). He made specific reference to the possibility of strategic behaviour with respect to the use of surveys. Samuelson's point, repeated in many textbook discussions of public goods, had a strong effect on how economists view the survey questions. The wrong inference made by many CVM critics is to equate strategic behaviour with lying. As the term is used in the modern mechanism design literature in economics, "strategic behaviour is merely synonymous with a rational agent maximising (broadly defined) self-interest" (Carson et al. 1999, p. 3). Mechanism design theory has shown that the optimal strategic behaviour for the individual consumers in many instances is to truthfully reveal their preferences. Whether this is the case or not depends upon the particular format of the survey elicitation question and other aspects of the scenario, including the payment vehicle and the level of information. These issues are discussed in the following sub-sections.

6.2 The Choice of the Elicitation Question

Much of the attention focused on the binary choice question elicitation format in recent years is due to the NOAA Panel on Contingent Valuation's recommendation for its use. One of the reasons underlying the Panel's recommendation is related with the fact that the dichotomous (binary) choice format is an "appropriate elicitation mechanism for estimating the demand for public goods" because of its (defensive) properties with respect to strategic bidding behaviour. Indeed, one of the core results in mechanism design theory as derived by Gibbard and Satterthwaite (Gibbard 1973, Satterthwaite 1975) is that the binary choice question is the only response format that is potentially incentive compatible in the sense that truthful preference revelation represents an optimal (and the dominant) strategy for the respondent. It has been long known that in some settings the binary choice question format is incentive compatible (Farquaharson 1969). The best-known examples are political races with only two candidates and binding (approve/disapprove) referendums with plurality (usually majority approval) vote

requirement. The discussion of whether the binary choice question meets the incentive compatible property raises two questions.

The first question is whether it is the binding nature of the referendum that makes it incentive compatible. Carson, Groves and Machina (1999) considered "an advisory referendum vote", i.e. the government is more likely to undertake an action the larger in the percentage in favour, and showed that such vote rule is incentive compatible. The second question is whether substituting an "advisory survey" for an "an advisory referendum" alters the incentive properties of the mechanism. Green and Laffont (1978) have shown that the economic mechanism geared by the binary choice question can be implemented using a sampling approach rather than complete information. These two arguments were reiterated in a recent paper by Carson, Groves and Machina:

"It is possible to replace the binding nature of an incentive compatible referendum with the more general assumption that the government is more likely to undertake the action the higher the percentage in favour. It is also possible to substitute a survey of the public good for a vote of the public on the issue. Neither of these changes, alone or together alter the original incentive structure of the binding referendum" (Carson et al. 99, p. 11)

In a paper Hoehn and Randall (1987) illustrated the case for truth telling as the individually optimal strategy in a policy referendum model. The authors conclude that the *"values elicited with parametric cost referendum format weakly dominate the valuations obtained with a* [open ended] *willingness to pay format."* (p. 237 - p. 239). The authors consider that when choosing within the dichotomous choice referendum, the respondent is informed that (a) the proposed policy is implemented if the majority of the respondents approves it, and that (b) for each respondent approval is conditional on an individual cost as stated in the survey instrument. Since the respondent is uncertain about how others will vote, and (a) holds, then she faces an incentive for participation. Therefore, the respondent considers her vote as decisive to approve (or reject) the environmental improvement. If the survey stated cost is lower than the individual's subjective willingness to pay, then the respondent attains a welfare gain if the project is approved, and thus it is optimal to report approval. Conversely, the survey stated cost is higher than the individual's subjective willingness to pay, the respondent suffers a welfare loss if the project is approved and it is optimal to report disapproval. It is important to remark, however, that it is not casting the preference question as a referendum that provides its desirable incentive properties. It is the cast of the preference question is terms of being able to influence a government decision with a binary agree/not agree format.

On the contrary, when choosing for open ended elicitation question format, the respondent is informed that the (a) the proposed policy is implemented if the sum of the reported aggregated benefits exceed the costs and that (b) each respondent pays in proportion to the sample mean bid. This setting may lead respondents to misrepresent preferences and stating a bid that is not their true bid but a bid sufficiently small enough to manipulate the sample mean bid in the hope of getting "something for nothing" (Bohm 1972, p. 113). In other words, the respondent may attempt to give "false signals" and wait to see if the good is provided without her contribution. The empirical evidence shows that, on average, the open ended estimation results are, on average, lower when compared to the dichotomous choice referendum estimates. This empirical finding suggests that understating may be the overwhelming bidding force in the open ended elicitation question format and this is interpreted as free-riding to the supposed lower overall mean.

6.3 The Choice of the Payment Vehicle

A key assumption is being made in the preceding discussion of the binary choice question as an incentive compatible mechanism. The assumption is that the government can compel payment for a good if provided. The ability to coercively collect payment for the provision of the public good is the property that causes the agent to try to influence the government's decision in the desired direction taking into account both the costs and the benefits of the action to the respondent. Relaxing such an assumption will destroy the incentive properties of the referendum advisory survey - see Table 6 (Adapted from Carson et al. 1999, p. 17).

Table 6. Incentive properties of binary discrete choice questions

Type of Good and Nature of the Payment Obligation	Incentive Property
New public good with coercive payment	Incentive compatible
New public good with voluntary payment	Not Incentive compatible

To illustrate Table 6, let us consider the case where a (charitable) organisation wants to provide an increase in the environmental quality of a natural park (e.g. creation of a habitat reserve) via voluntary contributions. A "yes" to the question of the form *"Is your household willing to pay $xx to purchase the habitat reserve if we started the fund"* will encourage the charitable organisation to undertake the fund-raising effort. Given the public nature of the environmental quality - once the habitat reserve is created there is no way that any individual could be excluded from its benefits - the optimal strategy of an agent who wants to visit the forest is to contribute less than her maximum willingness to pay for the good and, in many instances sit back and wait to see if the good is provided without her contribution. The reluctance of individuals to contribute to the support of public goods is a well-known phenomenon in the literature and referred to as the free rider problem.

One of the first CVM studies focused on the study of strategic bidding behaviour was presented by Swedish economist Peter Bohm. Bohm conducted a CVM experiment with the objective of testing whether value estimates are sensitive to the alternative configurations of the payment rules. Bohm's results do not rule out the hypothesis that different payment decision rules engage different strategic behaviour incentives, but the empirical evidence makes it unlikely that these differences are 'very large' – and this result is of considerable practical importance (see Bohm 1972). More recently, Champ et al. (1997) set up an experiment involving contingent donations and actual donations for an environmental project along the North Rim of the Grand Canyon. The project involved old, unpaved roads that must be removed before it can be officially designated as a Wilderness Area. The experiment was characterized by the use of two survey versions: one posed a dichotomous choice question which gave the opportunity to actually donate a specific amount for road removal, whereas the second asked a parallel contingent donation question. The estimations results showed that '23% of the contingent donation respondents were inconsistent in the sense that they said yes to the dichotomous choice contingent donation question but our model predicts that they not actually donate if they had been in the dichotomous choice actual donation treatment' – see Champ et al. (1997).

6.4 The Hypothetical Nature of the Survey Payment

Hypothetical bias is defined as the systematic difference between the stated payments response in a hypothetical market and the actual payments when individuals are presented with the opportunity in reality. Hypothetical bias may occur in the CVM responses because respondents may not be able to visualise the described scenario situation, or it may not seem realistic enough to spend time thinking it through. Respondents may also not believe that their answers will have any effect on the policy. More recently, the divergence between actual and survey behaviour may also be interpreted (and expected) as additional empirical evidence of strategic behaviour in CVM surveys.

To see this, let us return to the case where the government wants to provide a forest recreation area. The incentive structure is illustrated in Table 7 (Nunes, 2002). If one takes a compulsory tax as the payment vehicle, the government can compel payment for the public good if the majority of the electors vote for the provision of the forest recreation area. Therefore, the agent perceives that she is able to influence a government decision and her optimal strategy is to state her true

valuation of the public good. On the contrary, if we consider that a (charitable) organisation wants to provide the forest recreation area via voluntary contributions, the optimal strategy of an agent who wants to visit the forest is to contribute less than her maximum willingness to pay for the good and, in many instances to contribute nothing. This is the classic free riding incentive behaviour - see arrow (a) in Table 7. However, Carson et al. (1999) argue that *"the same incentive structure which should cause free riding with respect to the actual contributions should induce respondents in a survey to over pledge because doing so helps to obtain the latter opportunity to free ride"* (p. 12). Therefore, according to these authors the survey based predictions of contributions, when compared to the actual contributions, are influenced by an over pledge incentive - see arrow (b) in Table 7. The hypothetical bias is difficult to test, except by comparison with real-payments. But clearly, if it was possible to obtain real-cash-payments for the good in question, the CVM method would not be necessary. However, there are some CVM experiments that combine the use of the hypothetical market value elicitation with actual payments. The empirical evidence has not always supported Carson's et al. "Over pledge" argument. One possible reason for the discrepancy between the intended and actual behavior is that an individual may judge her consumption from a public good (e.g. preserve a habitat reserve) as something quite different from consuming the same good as a private one (e.g. WWF membership fee). Hence, *"the transformation of a public good into a private good may be considered highly inefficient"*. Another possible reason explaining the difference between hypothetical and actual behaviour is the respondent's lack of foreknowledge of an obligation to pay in accordance with one's verbal statements. According to Navrud, *"a carefully constructed CVM survey should contain an explicit payment obligation"* (Navrud 1992, p. 245).

Table 7. Strategic behaviour, payment vehicles, and payment settings

Actual payment setting (with cash transaction)		Hypothetical payment setting (no cash transaction)
Compulsory tax	Voluntary contributions	Survey based contributions
Ability to coercively collect payment for the provision of the public good Agent is able to influence a government decision	Agent sits back and wait to see if the good is provided without her contribution Agent contributes less than her own WTP	Agent over pledges (Carson et al. 99) Agent contributes more than her own WTP
⇒ Incentive compatible	(a) ⇒ Not incentive compatible	(b) ⇒ Not incentive compatible

In contrast, other studies provide considerable evidence that hypothetical bias may not be a problem. Sinden (1988) conducted 17 experiments comparing the hypothetical and actual money donations to a fund for soil conservation and an eucalyptus planting program. He found that there was no statistical difference between the two markets in any of the experiments. Finally, some studies found that hypothetical estimates may even be slightly smaller than actual payments. Bateman et al. (1993) cite experiments that "clearly show that stated willingness to pay in a hypothetical market may be below the willingness to pay in a real market" (p. 39). Furthermore, Randall, Hoehn and Brookshire (1983) obtained lower willingness to pay responses from hypothetical markets. A possible reason for this situation is that in the "real market", the version of the good as a "private" (excludable and rival) good, introduces elements of competition, exclusivity and "auction fever" completely absent from the good conceived as a "public good". More recently, Nunes (2002, 2004) puts forward the idea that two valuation mechanisms, of

opposite sign, emerge simultaneously when answering survey based contributions. The first refers to free-riding, and thus reflecting in an incentive to lower willingness to pay responses from the survey. The second refers to the purchase of warm glow, i.e., an expression embedded in the WTP so as to acquire a sense of moral satisfaction. The later is reflecting in an incentive to increase willingness to pay responses from the survey. Nonetheless, the only problem with such cases, from the perspective of economic theory, is not whether there should be a divergence between actual behavior and the survey estimate, but rather whether the magnitude of the divergence empirically observed should be even larger, i.e., to assess whether *"the incentive in a survey to over pledge"* is indeed a statistically significant driving force of the stated WTP responses. Arrow et al. (NOAA 1993) suggest that the response to the issue of the hypothetical nature of the CVM method is to make both the hypothetical market and the payment vehicle as credible and realistic as possible. Moreover, the members of the NOAA Panel also recommend that CVM survey should contain, together with the explicit payment obligation, the use of budget constraint reminders and substitute reminders before eliciting the WTP question.

6.5 The Purchase of Warm Glow

Despite the fact that CVM survey design has been a target of extensive methodological research and quality improvements, this valuation method is an object of diverse critiques. The embedding effect is a major critique of the CVM method. Embedding is attributed to the possibility that CVM is insensitive to the scope of the public policy formulated in the instrument survey. Consider the question of the preservation of two natural areas: area 1 and area 2. Suppose that the WTP for the two areas jointly is $(X + C)$, where X is the economic value of preserving the areas, and C is the value attached to the warm glow of giving. Now suppose the answer to the question for area 1 individually is $(Y + C)$ and the answer to the question for area 2 individually is $(Z + C)$, where $X = Y + Z$. Then, the sum of the answers for the areas individually will be $(X + 2C)$, which is greater by the amount C than the answer for the two areas jointly. The argument for criticising the CVM method goes as follows: how can cost-benefit analysis and damage cost assessment rely on a valuation tool that discloses, for the same public good, different value estimates, whether the public good is valued alone or included in a wider policy program? Kahneman and Knetsch (1992) offered an explanation for embedding that has its roots in the individual consumer behavior. According to these authors embedding is not in conflict with the standard value theory; according to Kahneman and Knetsch embedding can be explained in terms of an impure altruistic motivation of the individual consumer, and that aspect of consumer behavior was not considered in the standard valuation framework. In other words, Kahneman and Knetsch proposed an explanation that maintains that the WTP for public goods is also an expression of WTP to acquire moral satisfaction: "respondents express a willingness to contribute for the acquisition of many public goods, and there is no reason to doubt their sincerity or seriousness. (…) What is the good that respondents are willing to acquire in CVM surveys? We offer the general hypothesis that responses to CVM questions express a willingness to acquire a sense of moral satisfaction, also known as warm-glow of giving.

Moreover, the moral satisfaction valuation transmission can be interpreted in the light of the general model formulation for private donations as initially developed by Andreoni (1989, 1990). According to Andreoni, the individual consumer contributes to the provision of a particular public good for two reasons. First, because the individual consumer simply wants more of it, i.e. the 'no satiety axiom'. Second, because the individual consumer derives some private benefit from giving to the good. Therefore, the individual consumer contribution to the public good enters into her utility function twice: once as a private good and once as a contribution to a public good. By inference, it seems plausible that the act of participating in a CVM market so as to assist in the supply of an environmental good could provide a mixture of private, warm-glow benefits and public services from the increased supply of the good. More recently, Nunes and Schokkaert (2003) explore the use of factor analytic information so as to characterize respondent's motivational profile, showing that the embedding problem in CV applications is linked to the warm glow effect. Moreover, the use of direct attitudinal information played a crucial role to get a better understanding of the real content of CV answers. In fact, it allowed for operationalizing

and estimating a "cold" WTP, i.e. a WTP measure for the case in which all respondents would be free from a general feeling of well-being or satisfaction generated by the act of giving, has worked reasonably well. The "cold" WTP estimates are lower than the original estimates and formal testing has shown that they do not violate the adding-up property. Therefore, if one takes the view that the original WTP estimates do not reflect "economic preferences" because they contain an altruistic motive and should therefore not be used for cost-benefit exercises (Milgrom 1993); this procedure of "cooling down" the altruistic motive might offer a way-out. Further refinement of our method could even lead to a better distinction between the different components of "altruism". One could as well argue, however, that "warm glow" is a legitimate component of WTP and should therefore not be disregarded. Since our results suggest that the problems with the embedding effect do not necessarily point to inconsistent response behaviour but can be explained by the existence of a stable and measurable warm glow component in individual preferences, they also give support to the direct use of the uncorrected original WTP measures.

7. Conclusions

An environmental resource asset, such as the conservation of a natural area, provides a wide range of benefits. Generally speaking, the conservation benefits are classified in terms of the natural area's provision of use and non-use service flows. The use benefits, like the name suggests, refer to a set of recreational possibilities that the individuals are able to experience when visiting the natural area, e.g., hiking or simply enjoying the aesthetic satisfaction of being in such natural environment. The non-use benefits refer to the set of activities (not necessarily associated with any human use) that the natural area is also able to provide, e.g., areas closed to the general public and created to guarantee the protection of the local biodiversity in their natural habitat. Different valuation instruments are available to the researcher as to assess such conservation benefits. CVM is an important valuation technique and since it is the only one capable of assessing the value of the non-use benefits - which are characterized by having no behavioural market trace - therefore, economists cannot glean information regarding these values by merely relying on market-based valuation approaches. Today the CVM method is a well known benefit valuation technique of non-market goods and services and is widely used within the framework of cost-benefit analysis and natural damage assessment. The CVM method consists of implementing a market with the help of a survey directed to the individual consumer. The principal idea underlying this method is that individuals not only have preferences defined over the described environmental good, but also are capable of transforming these preferences into monetary units. In the present work, we present the link of contingent valuation method to standard economic theory as well as carry out a survey on CVM, discussing the state-of-art survey design guidelines. The overall goal is to ensure the validity of the proposed survey as a measurement instrument. In the valuation exercise, we are particularly interested in the study of possible behavioural incentives underlying respondent's behaviour, paying particular attention to strategic behavioural issues, such as free riding, and the purchase of warm glow. Free riding and the purchase of warm glow display opposite effects on individual respondent's bidding. Whereas free riding is characterized by an incentive to understate individual willingness to pay, the presence of warm glow signals the occurrence of a potential over pledging. Recent attempts to introduce attitudinal information into the analysis of CV answers reveal the warm glow effect has an important influence on the WTP answers seems to be rather robust. The use of direct attitudinal information may play a crucial role to get a better understanding of the real content of CV answers.

All in all, these contributed CV methods to gain much popularity in recent years. They have proven empirical validity in a wide variety of environmental economic problems. It is noteworthy that the city – the place par excellence for both positive and negative externalities – has received far less attention in the great many efforts to introduce CV methods as a powerful analytical tool. This offers a great challenge for research, as almost all issues studied in modern CV analysis are present in urban quality of life, such as conservation issues, ecological diversity, and so forth. More research would be needed to make CV a well- accepted analytical tool for studying urban

quality of life. The prospects are favourable as CV methods incorporate a wealth of solid economic perspectives that render in urban life.

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