Is More Information Always Better? The Effect of Information on the Validity of Contingent Valuations

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ABSTRACT

Within the framework of consumer's surplus, a theory of Contingent Valuation (CV) is introduced which accommodates a cost-parameter for the good or policy to be valued. This theory is then used to discuss the validity of value estimates established by means of CV-instruments with different (cost-) information. Against the prevailing view that such instruments must contain a description of how the good to be valued is meant to be generated and how this generation is to be financed, it is argued that, if the aim of the valuation is to establish compensatory damages, then the 'safest' instrument (i.e. the least likely to be biased) is the one where the good is said to be provided for free, without any further information about means of generation or payment vehicle. Indeed, it is shown that the inclusion of such further information opens up the possibility of an array of different biases which would invalidate the estimates for the purpose of establishing compensatory damages. Although there is no theoretically predictable direction for these biases, the mere fact that they may exist does put a question mark on the compensatory damage figures which have been estimated according to the current practice of CV.

CONTENTS

1. INTRODUCTION[1]

'Contingent Valuation' ('CV') is the name given to a survey method in which respondents are asked, contingent upon certain hypothetical assumptions, to state how much they would maximally be willing to pay for something. CVs, in other words, are a species of economic survey valuations, characterised by the fact that their willingness-to-pay questions are framed in a hypothetical (market) context. This makes them the outstanding candidate for measuring the so-called 'non-use' values, usually associated with environmental goods and the preventing of their degradation (the existence of endangered species, the option to visit an intact celebrated beauty spot and so on).

The CV methodology, whose conceptual origins lie in the framework of welfare cost-benefit analysis developed by Harold Hotelling and John Krutilla, entered on the political stage with the US *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA), with its provisions concerning the recovery of compensatory damages for injury to, destruction of or loss of natural resources resulting from the release of hazardous substances or oil. In order to recover these damages, the act designates federal or state authorities to act on behalf of the public as trustees for natural resources in assessing and bringing actions to recover these damages. On 1 August 1986, the U.S. Department of the Interior (DOI) promulgated the final CERCLA regulations. As concerns compensatory damages, these regulations specified that the diminution in market price should be used to estimate the damages if there existed a reasonably competitive market for the injured resource. Alternatively, if market prices were not appropriate, the damage estimate should be based on the loss in appraised value using commercial appraisal techniques. Only if the trustee had determined that neither the market price nor the appraisal methodologies were appropriate could non-market valuation methods be used, including travel cost, hedonic pricing, unit day values, and CV. Here, too, there was a hierarchy: the use of CV to measure existence or option value was permitted only if no use values could be ascertained. Thus, both CV and non-use values were firmly relegated to an inferior status. It was thus not surprising that almost immediately, an application for review of these regulations was made to the Federal Court of Appeals (D.C. Circuit) by several state governments, as well as

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[1] The author is grateful for comments received on earlier drafts by Jonathan Baron, Anthony Heyes and Sahotra Sarkar.

environmental organizations. In what became known as *Ohio v DOI*, the court invalidated DOI's rigid value hierarchy and thus put CV on equal footing with the other compensation assessment methodologies.

The second act of the dispute about CVs began, in the wake of the Exxon Valdez disaster in 1989, with Congress passing the *Oil Pollution Act of 1990* (OPA), superseding CERCLA with respect to oil spills. The *National Oceanic and Atmospheric Administration* (NOAA) – an agency within the Department of Commerce – charged with promulgating the relevant damage assessment regulations took the unprecedented step of convening a 'Blue Ribbon' panel, co-chaired by Kenneth Arrow and Robert Solow, to assess the CV methodology. If anything, their conclusions managed to inflame the already acrimonious dispute about the reliability and validity of CV.

Having thus passed the ordeal of more than ten years of debate, the study of CV seems to have come of age, at least insofar as the emergence of axioms – assumptions which are held to be self-evident – can be judged as a sign of a mature science. In this essay, I intend to put forward some slightly heretical views about a group of axioms to do with the nature of information in CV-surveys. Although not explicitly stated, the nature of these axiom emerges, I believe, quite clearly from a passage of the Panel report in which the Panel identifies:

> a number of stringent guidelines for the conduct of CV studies. These require that respondents be carefully informed about the particular environmental damage to be valued, and about the full extent of substitutes and undamaged alternatives available. In willingness to pay scenarios, the payment vehicle must be presented fully and clearly, with the relevant budget constraint emphasized. The payment scenario should be convincingly described, preferably in a referendum context, because most respondents will have had experience with referendum ballots with less-than-perfect background information.[2]

The Panel is naturally aware of there being limits to how much information a subject can actually digest,[3] but the gist nonetheless seems to be that to leave out 'realistic' information which would not overtax the subject's cognitive abilities is to provide him with less-than-perfect information. Indeed, on another occasion Arrow expresses the view that 'evidence indicates that the more you structure a situation to be a pseudo reality the more real-like are the results you elicit'.[4] The view

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[2] Arrow *et al.*(1993): 4610.

[3] '[These] guidelines must be satisfied without making the instrument so complex that it poses tasks that are beyond the ability or interest level of many participants.'[Arrow *et al.*(1993): 4609]

[4] Arrow (1986): 184.

which I therefore propose to re-examine in the following discussion is that, in principle – i.e., in abstraction of cognitive limitations – factually correct (or, at least, 'realistic' hypothetical) information is *always* good for valuation purposes. In particular, my focus will be on information linking the (public) good to be valued with descriptions of how that good is to be provided and how this provision is to be financed, information which has become accepted as a *sine qua non* for 'realistic' CV scenarios.

An analysis of this sort evidently depends on what one understands by CVs. Although there are still at least two vying conceptions,[5] opinion generally seems to have settled on what I shall term the 'standard theory' which explains CVs in terms of consumer's surplus. Since I am by nature averse to iconoclasm for its own sake, I shall try to argue my case from within the general framework of this standard theory. In order to do so I will, however, be obliged to introduce in Section 2 a slightly generalised version of this traditional conception. Having done this, I shall then turn to discuss in Section 3 the advantages and disadvantages (from the standpoint of this theory) of certain CV-instruments with a 'minimal' informational content. In Section 4, I then turn to discuss the more traditional instruments involving descriptions of how the goods to be valued are meant to be produced and how this is to be financed. In this context it will, in particular, be argued that the inclusion of a payment vehicle – a *sine qua non* according to the Panel – opens the possibility of an 'information bias' even if everything is properly interpreted by the subject. After a critical look in Section 5 at some of the views about the role of information in CVs which have been put forward previously, the findings of this essay are summarized in the concluding sixth section. Yet in order to reach these conclusions, we must start at the beginning by finding out what exactly the standard theory has to say about the workings of CVs.

[5] Amartya Sen (1995), for example, calls for an interpretation of CVs in social *choice* terms, which, as will become clear shortly, is quite different from the explication adopted in the standard theory.

2. THE STANDARD AND THE GENERAL CONSUMER'S SURPLUS THEORY

The Standard Theory

The standard theory of CVs is based on the familiar welfare-theoretic notion of a *compensating variation* as monetary measure for consumer's utility surplus. As in all consumer's surplus based theories,[6] the first step taken towards explaining the CV of an increase in some good (the 'target' of the valuation) is to associate a particular utility difference with this increase. This is normally achieved by switching to some indirect utility function which means the subject is assumed (i) to make an Arrow-type choice that can be used to identify a utility for the specified initial target-good level, and (ii) one which does the same for the final target-good level.[7]

Take, for example, Anthony Fisher's recent exposition of CVs in his article on 'The Conceptual Underpinnings of the Contingent Valuation Method': having introduced a utility function U as representation of preferences over bundles of a private good x and a public good z (say clean air),[8] he introduces an Arrow-type choice by describing the subject as maximising utility in choosing exclusively between the levels of the market good. This leads him to turn to what he calls the 'ordinary' demand function $\bar{x}(z, p, y)$,[9] resulting from optimising $U(x, z)$ under the constraint that $p\,x \leq y$, which – in the case of just one private good – is constant and coincides with the relevant budget line: $\bar{x}(z) = p \cdot y$. Having singled out this particular demand function, he then takes what might be called the 'consumer's surplus turn' by introducing the corresponding indirect utility function $\bar{v}(z, p, y) = U(\bar{x}(z, p, y), z)$. Thus, when he asks us to consider an improvement of the environmental quality from an initial level $z = z^0$ to a final level $z = z^1 > z^0$ (leaving price and income unaltered at, say, $p = p^0$ and $y = y^0$), he is actually asking

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[6] I use the term 'theory' to refer to an explanatory description (in general terms) of what the theory 'is about', i.e., in our case, the figures elicited in CV surveys.

[7] Any choice in Arrow's sense is not only associated with a unique utility (preference level), but – when specified in a suitably parametrised form – can give rise to a particular demand function, which in turn defines a particular indirect utility. However, it is important to keep in mind that many different types of choices can be specified for any kind of alternatives, and hence that there can be *many* different indirect utility functions based on one and the same direct preference structure.

[8] Strictly speaking, Fisher considers commodity bundles comprising an array of market goods and an array of public goods, constrained by an appropriate array of prices and an income parameter. However, for the sake of illustration, I am paraphrasing his account in terms of just one of each type of good.

[9] 'p' and 'y', as usual, refer to the price of the market good and the subject's income, respectively.

us to consider an 'indirect' change between two particular bundles, namely from $S_0 = <\bar{x}(z^0, p^0, y^0), z^0>$ to $S_1 = <\bar{x}(z^1, p^0, y^0), z^1>$ (see Fig. 1), a change which – in contrast to the change in the public good *per se* – is indeed associated with a specific consumer's surplus:

$$\Delta U = U(S_1) - U(S_0) = \bar{v}(z^1, p^0, y^0) - \bar{v}(z^0, p^0, y^0).$$

Again when he explains that the 'compensating variation measure [cv, Fig. 1] of the utility change [ΔU] is the amount of money that, if extracted from the individual after the change in z from z^0 to z^1, will leave him just as well off as he was before the change,'[10] he is *actually*

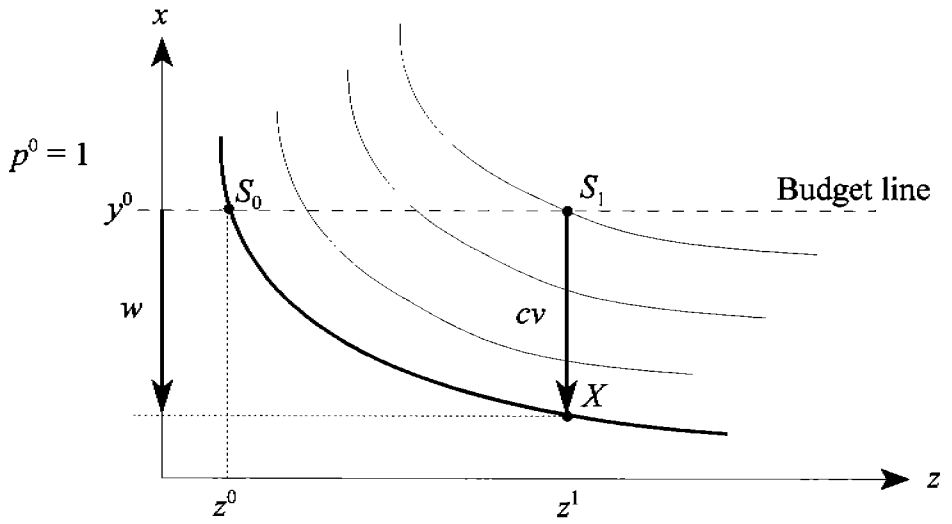

Fig. 1: *The Standard Theory*

talking about the 'indirect' change from S_0 to S_1. Having introduced the compensating variation for ΔU, he concludes his explanation by contending that 'this compensating variation can also be considered the WTP [maximum Willingness-to-Pay] for the change. It is this amount which a CV survey attempts to elicit from a respondent.'[11]

[10] Fisher (1996):20. The compensating variation cv is, of course, implicitly defined by the equation $\bar{v}(z^0, p^0, y^0) = \bar{v}(z^1, p^0, y^0 - cv)$.

[11] Ibid.

The Market Version of the Standard Theory

To understand the assumptions involved in this standard theory, it may be helpful to look at what a 'market version' of Fisher's account, i.e., a version in terms of only market goods, might be. Consider two market goods, say apples ('a') and bananas ('b'), with (market-) price variables denoted by 'p_a' and 'p_b', and assume that the interest is in valuing banana increases (bananas are the target-good). What type of choice/demand for apples would, in this context, correspond to the demand for x adopted by Fisher? Since he did refer to the latter as being 'ordinary', what springs to mind is the demand determined by an optimization under the usual market budget constraint $p_a a + p_b b \leq y$, which results in the 'ordinary' demand functions $a(p_a, p_b, y)$ and $b(p_a, p_b, y)$ for apples and bananas, respectively, and the corresponding 'ordinary' indirect utility

$$v(p_a, p_b, y) = U[a(p_a, p_b, y), b(p_a, p_b, y), p_a, p_b, y].$$

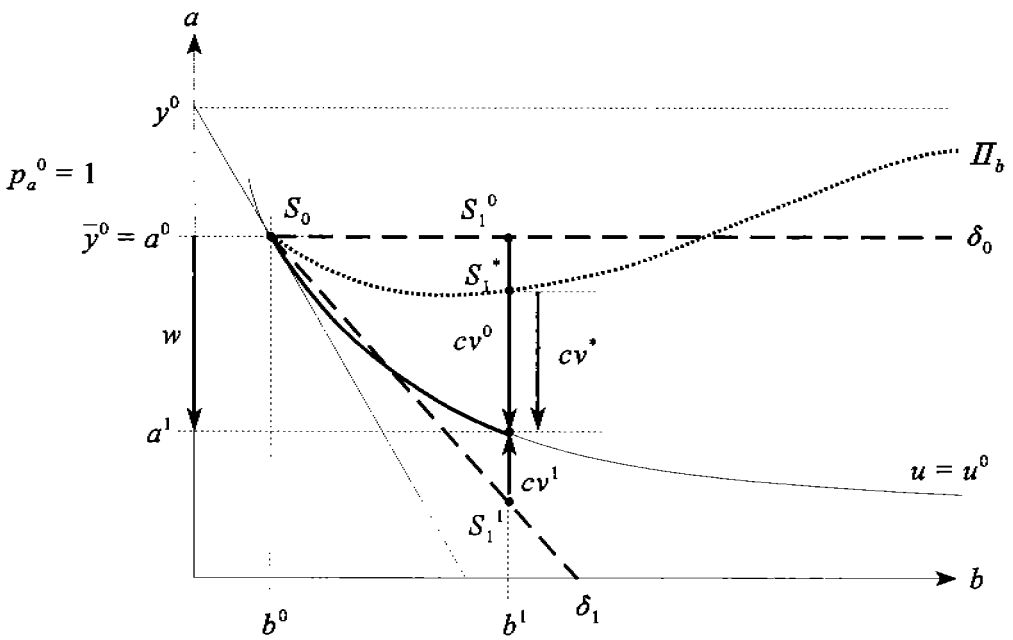

Fig. 2: The Market Version

Under what is to be the fundamental 'rational-*status quo*' assumption for the following discussion, namely that the initial state S_0 (the *status quo*) is such a choice – i.e., that the *status quo* values $y = y^0$, $p_a = p_a^0$, and $p_b = p_b^0$ are such that

$$\text{(SQ)} \quad S_0 = \langle a^0 = a(p_a^0, p_b^0, y^0), b^0 = b(p_a^0, p_b^0, y^0), p_a^0, p_b^0, y^0 \rangle$$

– a 'direct' increase in the provision of bananas from $b = b^0$ to $b = b^1 > b^0$ which leaves prices

and income unchanged can be identified with the 'indirect' change from S_0 to S_1^* (see Fig. 2), giving rise to the compensating variation cv^*.[12]

However, this 'ordinary' account cannot be a market version of the standard theory laid out above, since the demand for apples $a(p_a, p_b, y)$ fails to correspond to the demand for x in the standard theory in two important aspects: (i) the type of choice underlying $a(p_a, p_b, y)$ does not conform to the assumption in the standard theory that the demand for the good which is traded-in (x) is to be based on choices from opportunity sets with elements varying *only* in the levels of this good; and (ii) the resulting compensating variation (cv^*) is – contrary to the situation described in the standard theory – generally not equal to the relevant 'trade-off value' (w), by which I mean the monetary value of the maximum number of apples which the subject would be prepared to trade (barter) for the stipulated increase in the number of bananas in his possession.[13]

Having rejected this 'ordinary' account, my suggestion instead is to use the portion, say $\bar{y}^0$, of the income which remains in the *status quo* after purchasing the initial level of the target good – i.e., $\bar{y}^0 = y^0 - p_b^0 b^0$– to define a '*conditional*' demand $\bar{a}$ for $b^1 \geq b^0$ in terms of optimising $u(a, b)$ under the constraint that $b = b^1$ and $p_a^0 a \leq \bar{y}^0$.[14] As in Fisher's account, this demand is the result of maximising utility by choosing exclusively between amounts of the trade-in good (apples), and it is constant as function of the target level: $\bar{a}(b^1) \equiv p_a^0 a^0$ (graphically represented by δ_0 in *Fig.* 2).[15] Moreover, the compensating variation (cv^0) for the indirect change from S_0 to S_1^0 associated with the direct change from b^0 to b^1 is equal to trade-off value

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[12] Assuming that bananas are a 'normal' good, there will be a one-one correspondence between the levels of p_b, and the levels taken up in the relevant demand function, i.e., $b(p_a^0, p_b, y^0)$. Thus, given (SQ), one can identify an increase in the provision of bananas to level $b^1 \geq b^0$ with the corresponding change (decrease) in the level of p_b. In other words, the 'direct' change from b^0 to b^1 can be identified with the 'indirect' change from S_0 to
$S_1^* = \langle a(p_a^0, p_b^*, y^0), b(p_a^0, p_b^*, y^0), p_a^0, p_b^0, y^0 \rangle$ (with $b^1 = b(p_a^0, p_b^*, y^0)$),
i.e., the intersection of the p_b-expansion curve (Π_b) with the hyper-plane $b \equiv b^1$.

[13] In the choice environment of our 'market-fruit model', this will be determined by the difference between the *status quo* amount of apples and the one given in the bundle $X = \langle a^1, b^1, p_a^0, p_b^0, y^0 \rangle$ in which the *status quo* indifference curve $u = u^0$ intersects the target level $b \equiv b^1$. Assuming furthermore that the change in the provision of bananas ($\Delta b = b^1 - b^0$) does not affect the price of apples as specified in the *status quo* scenario (SQ), the trade-off value of Δb *relative to* S_0 will be $w = p_a^0 \cdot (a^0 - a^1)$.

[14] $u(a, b) = U(a, b, p_a^0, p_b^0, y^0)$

[15] The assumption here being, apart from the usual convexity of preferences, that the reference case is indeed of the form (SQ), which implies that $\bar{y}^0 = p_a^0 a^0$.

(w) of the latter.

As bananas are generally not given away for free, the crucial point emerging from this version is the necessity of distinguishing between the market price (p_b^0) paid for the initial level of bananas and the price (or, for that matter, cost) quoted for the stipulated banana increase, for it is clear that, in the version proposed above, the latter has to be nil. This is to say, the proposed market version of the standard consumer's surplus theory must be interpreted as a special case of a theory for scenarios in which the subject is told that the stipulated increase in bananas will incur a cost (determined by a '*stated*' price $\hat{p} \geq 0$, not necessarily the same as the market price p_b^0): $c_{\hat{p}}(b^1) = \hat{p} \cdot (b^1 - b^0)$. This general theory is given by introducing the said cost as an additional parameter into the underlying preference structures by exchanging our utility function for $U = U(a, b, p_a, p_b, y, c)$ and then using the *conditional* demand for apples: $\hat{a}(b, c_{\hat{p}}(b)) = \bar{y}^0 - c_{\hat{p}}(b)$ – i.e., δ_0 and δ_1 (for $\hat{p} = 0$ and $\hat{p} > 0$, resp.) in Fig. 2 – determined by:

$$\begin{array}{lll} & \text{(i)} & p_a = p_a^0,\ p_b = p_b^0,\ y = y^0,\ b = b^1 \geq b^0, \\ \text{(C)} & \text{(ii)} & c = c_{\hat{p}}(b), \text{ and the budget constraint} \\ & \text{(iii)} & p_a a \leq \bar{y}^0 - c \end{array}$$

to specify the utility of the *final* target-good level as given in the conditional indirect utility function $\hat{v}(b, p_a, p_b, y, c_{\hat{p}}(b)) = U(\hat{a}(b, c_{\hat{p}}(b)), b, p_a, p_b, y, c_{\hat{p}}(b))$.[16] Assuming the subject would be better off after having received the additional amount of bananas $b^1 - b^0$ at the quoted price $\hat{p}$,[17] the maximal amount of money (cv) which could be taken away from him, *after* having received the additional bananas in order to be no worse off than before, is given by the equation:

$$\hat{v}(b^0, p_a^0, p_b^0, y^0, c_{\hat{p}}(b^0)) = \hat{v}(b^1, p_a^0, p_b^0, y^0 - cv, c_{\hat{p}}(b^1)).$$

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[16] Note, incidentally, that – given our rational *status quo* assumption (SQ) – the theory proposed here is actually based on two quite different types of choices: the utility of the *initial* target-good level is taken to be determined by an 'ordinary' choice, while that of the *final* level is assumed to be given by a *conditional* choice. A full description of the theory would hence have to involve two related but still quite different indirect utility functions.

[17] This need by no means be so. Take, for example the case illustrated in Fig. 2 where the price quoted for the banana increment, say $\hat{p} = \hat{p}^1$, entails a cost $c_{\hat{p}^1}(b^1)$ which pushes the subject's conditional demand $\hat{a}(b^1, c_{\hat{p}^1}(b^1))$ – depicted as δ_1 – to a level such that the subject would be worse off at $S_1^1 = <\hat{a}(b^1, c_{\hat{p}^1}(b^1)), b^1, \ldots>$ than he was initially. In this case, the compensating variation cv^1 would be negative, i.e., he would actually have to be *compensated* for the stipulated increase in bananas *at the quoted price* $\hat{p} = \hat{p}^1$.

As $\bar{a}(b^1) = \hat{a}(b^1, 0)$, it is not difficult to see how the standard (market) theory fits into this general framework. The important point is simply that it needs to be interpreted in this general context, i.e., that it must be seen as a theory for scenarios where the subject is either told, or implicitly assumes that the stipulated increase is free of charge.

The General Consumer's Surplus (GCS) Theory

The proper framework for consumer's surplus interpretations of CVs concerning market goods thus has to involvebe preference structures with a cost-parameter. And the same, I contend, is true in the context of public goods. Indeed, Per-Olav Johansson, in his own description of the standard theory, explicitly states that 'the public good or change in environmental quality is supplied free of charge',[18] and given our account of the market-fruit example, it is straightforward to describe the general consumer's surplus theory for the CV of public goods: all we need to do – say again in the context of one private and one public good – is (i) to incorporate a cost parameter 'c' into the underlying preference structure by using a utility function of the form $U = U(x, z, p, y, c)$, (ii) to relate this cost parameter to increment levels $z^1 \geq z^0$ by introducing a *consumption cost* function $c(z^1) \geq 0$ with $c(z^0) = 0$, and (iii) to introduce a conditional demand $\hat{x}$ for the private good at this incremental public good level as the consumer's choice under the constraints:

$$
\begin{array}{lll}
 & \text{(i)} & p = p^0,\ y = y^0,\ z = z^1 \geq z^0 \\
\text{(C′)} & \text{(ii)} & c = c(z), \text{ and the budget constraint} \\
 & \text{(iii)} & px \leq y - c.
\end{array}
$$

The fact that (for $p^0 = 1$) this conditional demand: $\hat{x}(z^1, c(z^1)) = y^0 - c(z^1)$ is equal to the *status quo* consumption x^0 for the nil-increment ($z^1 = z^0$) allows us, on the one hand, to describe the *status quo* S_0 in indirect terms as $S_0 = <\hat{x}(z^0, c(z^0)), z^0, p^0, y^0, c(z^0)>$, and, on the other, to identify the direct increment in the public good from z^0 to z^1 with the indirect change from S_0 to $S_1 = <\hat{x}(z^1, c(z^1)), z^1, p^0, y^0, c(z^1)>$ and thus to associate the stipulated direct change with a particular utility increment: $U(S_0) - U(S_1)$, or in the more familiar indirect utility formalism:

[18] Johansson (1993): 26.

$\hat{v}(z^1, p^0, y^0, c(z^1)) - \hat{v}(z^0, p^0, y^0, c(z^0))$.[19] To illustrate this (Fig. 3 and 4), I have chosen to focus on simple linear cost functions, that is functions of the form: $c_\zeta(z^1) = \zeta \cdot (z^1 - z^0)$ with $\zeta \geq 0$. This, of course, generates linear conditional demands for the private good, as exemplified in the demand curves δ_0 and $\delta_{1/4}$ (for $\zeta = 0$ and ¼, resp.). Given the dependence of these demands on the cost parameter ζ, the same dependence – notationally reflected by a superscript ζ – holds for the final indirect state: S_1^0 and $S_1^{1/4}$ thus denote the *final* state attained under the cost $c_0(z^1) = 0$ and $c_{1/4}(z^1) = 1/4 \cdot (z^1 - z^0)$, respectively.[20]

Given this, the compensating variation cv^ζ – i.e., the amount of money defined in the usual manner by:

$$\hat{v}(z^0, p^0, y^0, c_\zeta(z^0)) = \hat{v}(z^1, p^0, y^0 - cv^\zeta, c_\zeta(z^1))$$

– will, as a rule, correspond to the full willingness-to-pay of a neo-classically 'rational' subject only in the case of zero-cost instruments ($\zeta = 0$), since this WTP will have to include the stipulated (hypothetically) incurred cost: the maximum willingness-to-pay WTP^ζ of a 'rational' subject under a ζ-cost scenario is given by

$$\text{(WTP)} \qquad WTP^\zeta = cv^\zeta + c_\zeta(z^1).$$

To be sure, my claim here is *not* that people will always process (cost-) information presented to them in CV-surveys in a manner compatible with this theory,[21] it is merely that if they were indeed 'rational' in this technical sense then – *pace* McFadden and Leonard[22] – the proposed

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[19] $\hat{v}(z^1, p^0, y^0, c(z^1)) = U(\hat{x}(z^1, p^0, y^0, c(z^1)), z^1, p^0, y^0, c(z^1))$

[20] The indifference curves in the goods-plane, incidentally, are given by the conditional utility function $u_\zeta(x, z) = U(x, z, p^0, y^0, c_\zeta(z^1))$.

[21] Indeed, there is some empirical evidence – e.g. Schkade and Payne (1994) – which seems to suggest that 'rational' consumers are a very rare species indeed.

[22] 'For a specified allocation of public goods, the rational consumer will maximize utility in the market good. The level of this maximized utility is then given by an indirect utility function $V(z^1, p^0, y^0 - c(z^1))$. Faced with a choice between a public-goods allocation z^0 with associated cost $c(z^0)$ and an allocation z^1 with associated cost $c(z^1)$, the consumer will select z^1 if it yields higher utility:

$$(1) \qquad V(z^0, p^0, y^0 - c(z^0)) < V(z^1, p^0, y^0 - c(z^1)).$$

If z^0 denotes the *status quo*, then this consumer's WTP for z^1 is the amount W, so that when $c(z^1)$ is replaced by $c(z^0) + W$, the consumer is indifferent between the two alternatives:

GCS theory would be the correct consumer's surplus explanation of the working of CVs.

The reason for my dwelling somewhat longer than usual on the derivation of a CV-theory for 'rational' consumers was to support the following two conceptual claims: (i) consumer's surplus theories of CVs *do* involve a cost (zero or positive) of the commodity increase to be valued, and this cost has to be incorporated in the theory as a preference parameter; (ii) there is what might be called a 'minimal' interpretation of this cost as 'pure consumption cost,' that is to say the relevant cost figures can be interpreted as providing no more information than the implied reduction of the disposable income for the (hypothetical) conditional choice with which the 'rational' subject – in the consumer's surplus framework – is meant to establish the utility of the final target-good level in question. This interpretation is 'minimal' in the sense that while costs will always have this reduction of disposable income effect, they can be introduced (as we shall see in Section 4) in terms which provide additional information. But before we turn to these informationally extended scenarios, let me point out certain theory conforming ways in which things can go 'wrong' even in the case of survey instruments[23] which adopt the above-mentioned 'minimal' interpretation of the target-increase cost parameter.

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(2) $\quad V(z^0, p^0, y^0 - c(z^0)) = V(z^1, p^0, y^0 - c(z^0) - W).$

Then, the consumer prefers z^1 if $W > B = c(z^1) - c(z^0)$ and will respond "Yes" to a referendum that provides z^1 at an incremental cost, or bid B, and will give W in response to an open-ended question on the value of moving from z^0 to z^1.'[McFadden and Leonard (1993): 170f., paraphrased to fit our two commodity model.] Although intended as an explanation of CV instruments with a cost-component, McFadden and Leonard's theory does not actually cover positive-cost instruments: while starting out in their theoretical explanation of the consumer's WTP with an inequality (1) that captures positive-cost instruments, they then switch to an equation (2) which fails to do so. This becomes clear if one considers what the defining right-hand side of this equation amounts to in the case of $c(z^0) = 0$, namely $V(z^1, p^0, y^0 - W)$, i.e., $V(z^1, p^0, y^0 - c_0(z^1) - W)$. In other words, the WTP they explain is, contrary to what they imply, the WTP elicited in zero-cost instruments.

[23] Conforming with the usual practice, I use 'instrument' to refer to that part of a survey which is used to establish the targeted value. The 'core' of an instrument is the primary valuation *question*. By 'theory', on the other hand, I have in mind an account which enables us to explain how instruments of the relevant kind actually work.

3. TRADE-OFF VALUES, MINIMAL GCS-INSTRUMENTS, AND SENSITIVITY TO COST

To discuss cases where something goes wrong, we need to have at least a vague idea what it would be for it to go right, i.e., we need to make some assumptions as to what it is we are trying to measure with the instruments covered by the proposed GCS-theory. Moreover, it might be helpful if we knew a bit more about the format of the particular type of instrument we are meant to be discussing, namely GCS-instruments which incorporate the above-mentioned minimal interpretation of the cost-parameter. Beginning with the latter, my suggestion for such 'minimal' GCS-instruments is the sort designed around a core of the following format:

(GCS) If you were provided with an improvement in air-quality from its present level to z^1 at a total cost of C would you be (1) better off, (2) worse off or (3) as well off as you are at present?

If (1), what would be the maximal amount of money that could be taken away from you *after* the provision of z^1 for you to return to your present level of well-being? If (2), what would be the minimal amount of money that you would need to be given *after* the provision of z^1 for you to return to your present level of well-being?[24]

As part of a GCS-instrument, the answer elicited by these questions – in the case of (3) implicitly taken to be zero – is identified as the WTP, itself explained as the sum of the stated cost C and the relevant compensating variation. Now, we could simply adopt the convention that it is just this WTP which we are trying to measure, thus ensuring that the measurements would always by definition be valid.[25] Yet if we feel uneasy with this option, as I think we should, there is – at least in our two-commodity examples – an alternative, for it does not seem unreasonable to adopt the view that what we are trying to capture in such valuations is the trade-off value w of the stipulated target increment. The question then is whether the figures elicited in minimal GCS-surveys are valid estimates of these trade-off values? Or, to put it in the context of the previously employed parametric example, is it true that $WTP^{\zeta} = w$, whatever $\zeta \geq 0$ may be?

I believe that on the basis of our market-fruit example it can reasonably – albeit only heuristically – be argued that the figure ($WTP^0 = cv^0$) elicited by the zero-cost instrument ought

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[24] In the case of the 'zero-cost' instrument, the phrase 'at a total cost of $c(z^1)$' could, obviously, be replaced by 'for free'.

[25] 'Validity refers to whether an instrument (e.g., a question or set of questions) measures what it is intended to measure'[Schuman (1996): 77f.]

to be very close if not identical with the trade-off value (w).[26] Assuming thus, for argument's sake, that $WTP^0 = w$, we are left with the question about the status of the figures – such as $WTP^{¼} = cv^{¼} + c_{¼}(z^1)$ depicted in Fig. 3 – elicited by positive-cost instruments. As it happens, the situation illustrated in Fig. 3 suggests the simplest possible relationship between the WTP-figures elicited by such instruments, namely that they are all the same, regardless of the stated cost:

(R) $\qquad WTP^{\zeta} = WTP^{\zeta'}$, for all $\zeta, \zeta' \geq 0$

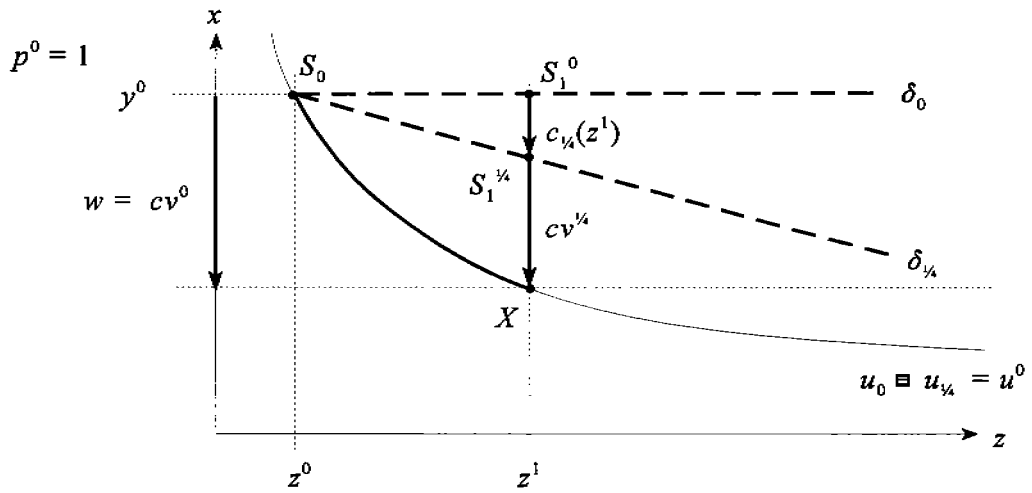

Fig. 3: *The Special Theory*

However, this will in general only be true if, for any given p, y, c, the conditional xz-preferences are the same whatever c may be, which is to say, if x, z, p, and y are *separable*.[27] Without this 'separability assumption' the correlation (R) is irretrievably lost: as illustrated in Fig. 4, the GCS-framework allows for the possibility that the conditional preferences ($u_{¼}(x, z)$) at the level given by the final state ($S_1^{¼}$) of a positive-cost instrument determine a WTP-figure

[26] It does not seem unreasonable to identify the transaction described in the (market) trade-off instrument, – i.e.,, essentially, a trading in of apples for a pre-specified amount of bananas – with the transaction where both the provision of bananas and the giving away of apples are said to be for free. However, it needs to be emphasised that this 'basic identification' is an empirical conjecture and thus in need of verification.

[27] A detailed discussion of this notion can be found in Deaton and Muellbauer (1980): 127. For the specific cost functions illustrated in Fig. 3 this means that for any given $p = p^0$ and $y = y^0$, the conditional utility function $u_{\zeta}(x, z)$ is the same whatever ζ may be, and thus, in particular, that $u_0 \equiv u_{¼}$.

($WTP^{¼} = cv^{¼} + c_{¼}(z^1)$) which bears no theoretically predictable relation to the relevant trade-off value. In the absence of information about the separability of the subject's preferences, the most we can argue is that zero-cost WTP figures are valid estimates of the relevant trade-off values.

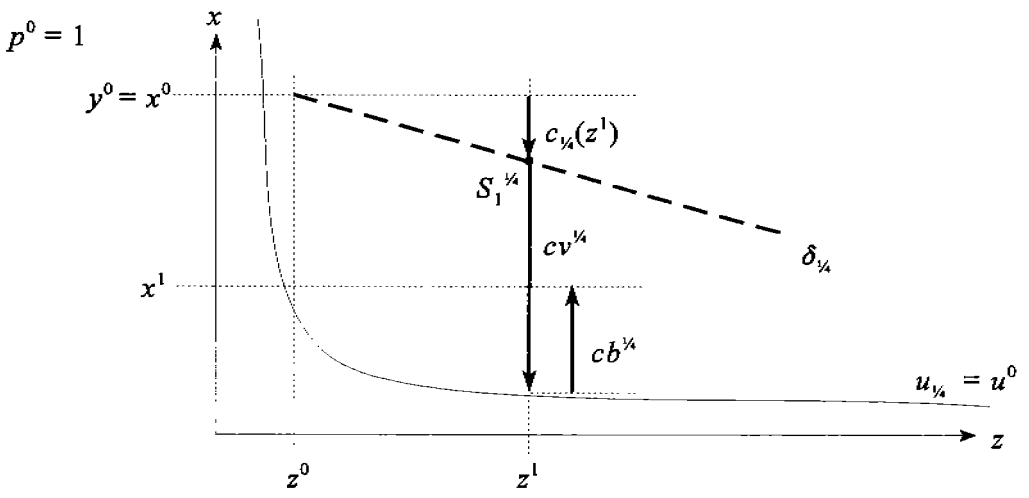

Fig. 4: *Sensitivity to Cost*

In light of a recent empirical study by Jonathan Baron and Nicholas Maxwell (1996), the state of affairs in which the values elicited in GCS-instruments are genuinely sensitive to the cost-parameter – and thus the presence of a 'cost-bias' ($cb^{¼}$) in positive-cost estimates – seems to be more than merely a theoretical possibility. They found that 'cost information affected WTP when it took the form of estimated cost or when it was simply implied by past expenditures or by descriptions of how a good would be provided.'[28]

While concurring with Baron and Maxwell's view that, in light of their findings, 'it is

[28] Baron and Maxwell (1996): 181. Baron and Maxwell put forward an interesting explanation of this phenomenon: they see it as an 'overextension of a useful heuristic'[p.181]. This heuristic, as I understand it, is a guide to values in which the stated cost is interpreted as containing information about the value of the good. Take our market-fruit example: if the stated incremental price $\hat{p}$ is (perceived by the subject as) not just a figure (randomly) chosen by the designer of the survey instrument, but a price determined by supply and demand then the subject may well adopt the following heuristic reasoning: (i) the way the price $\hat{p}$ has been established supports the conjecture that the value W which an 'average' consumer would attach to the stipulated banana increment is equal to the cost of this increment under this market price, i.e., $W = \hat{p} \cdot (b^1 - b^0)$, (ii) previous valuations of market goods support the assumption that the subject's preferences are usually quite similar to the ones of this 'average' consumer, and this gives him sufficient reason to assume that the value he attaches to the stipulated increment is its market cost, i.e., $w = W$.

somewhat disturbing that many CV surveys (e.g. Carson *et al.*, 1992) spend considerable time explaining the physical means of providing the good as well as the effects of providing it,'[29] I am hesitant to follow their conclusion that 'attempts to measure economic value of public goods might try to eliminate information from which costs could be inferred,'[30] since I do not think that we are in a position to discard GCS-instruments – which, as I argued, require cost information – altogether. My own conclusion, at this point, would rather be that amongst these minimal GCS-instruments, the 'safest' ones are probably the zero-cost ones.

[29] Baron and Maxwell (1996): 181.

[30] Ibid.

4. EXTENDED GCS-INSTRUMENTS AND SENSITIVITY TO FAIRNESS

Having drawn attention to a theory conforming weakness of positive-cost instruments, could it not be that this weakness is due to a lack of sufficient information, in particular, in our 'minimal' interpretation of the cost-parameter? Consider, for example, the survey mentioned by Baron and Maxwell which was carried out by Richard Carson *et al.* (1992) in the aftermath of the Exxon Valdez oil spill. This survey – undertaken for the Attorney General of the State of Alaska and generally regarded as one of the most carefully executed applications of the CV methodology to date – employed the following dichotomous choice questions to estimate the value of eradicating the risk of a major oil spill in Prince William Sound by means of an escort ship program:

A-15. Of course whether people would vote for or against the escort ship program depends on how much it will cost *their household.* – *At present*, government officials estimate the program will cost *your* household a total of $.... You would pay this in a special one time charge in addition to your regular federal taxes. This money would only be used for the program to prevent damage from another large oil spill in Prince William Sound. [...] would you vote for the program or against it?[31]

The stipulation that (i) the target good is to be generated by an escort ship program,[32] and (ii) that this program is to be financed by fiscal means, extends the information provided in this instrument beyond the 'minimal' informational content we have thus far considered. Indeed, far from just supplementing this minimal content, the information in (A-15) actually requires a re-interpretation of one of our parameters: in our 'minimal' interpretation, the cost-parameter 'c' is to be interpreted as the cost of 'consuming' the good and not of 'producing' it.[33] So what happens if we do adopt this 'extended' interpretation of the cost-parameter? For one, it will be clear that, in most cases, zero-cost instruments thus re-interpreted will become completely unrealistic. At the same time, we will – as witnesses in (A-15) – generally be compelled to introduce a suitable payment vehicle if we are to avoid the completely unrealistic 'lone-ranger' interpretation which Sen (1995) objects to. Yet in doing so we open up the possibility of a type

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[31] Carson *et al.*(1992): 3/56.

[32] Note that there can be no doubt in anyone's mind that such a programme could be run for free.

[33] Indeed, the reason why I avoided using the phrase 'paying for' in formulating the minimal GCS-instrument was to avoid ambiguities, since it can be used in both the context of consumption and production.

of 'informational bias' new to this discussion: while our minimal GCS-instruments were found to be subject to a possible bias due to sensitivity to cost, the extended instruments can *additionally* become subject to what Baron (1996: 155) referred to as 'sensitivity to fairness'. To illustrate this, let us return to our clean-air model and assume the sum $(t + t')$ – where t is the amount contributed by our subject – is estimated to 'produce' the target level $z^1 = z^0 + \varepsilon \cdot (t + t')$, for some $\varepsilon > 0$. In keeping with the payment mechanism espoused in (A-15), let us furthermore assume that t and t' are income-tax increments (paid by the subject and the rest of the population, respectively) and that their proportion is fixed by the ratio $T^0 \geq 0$ of the *status quo* income tax paid by the subject divided by that paid by the rest: $t/t' = T$.[34]

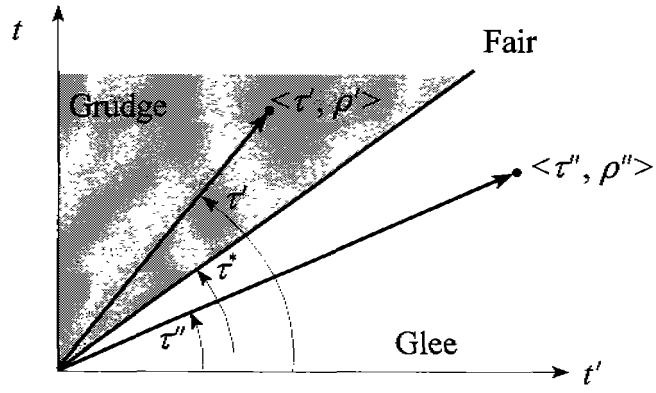

Fig. 5: Fiscal Parameters

Now, the important point is that if we extend our minimal GCS-instrument by adding a description of this payment vehicle we obtain an instrument the working of which is no longer adequately captured by our GCS-theory. To obtain a theory for this extended instrument we must indeed follow Sen's demand and switch to a description involving Arrow type 'social states',[35] i.e., we need to enrich our description of the relevant preference structure by introducing not just the tax-parameter t pertaining to the subject, but also the 'social' parameter t'. Our theory will

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[34] Note that, based on these assumptions, the production cost of z^1 to the subject will be

$$\frac{1}{\varepsilon \cdot (1 + 1/T)} (z^1 - z^0),$$

which means that if the cost parameter c is interpreted as this production cost, we may find a cost-bias which is correlated to both T and ε.

[35] See Arrow (1951): 17f.

thus involve a utility function of the form $U(x, z, p, y, c, t, t')$. Having said this, I propose, for the sake of simplicity of exposition, to re-describe the fiscal parameters in polar coordinates (τ, ρ) – as illustrated in Fig. 5 – and assume that x, z, p, y and τ are separable with respect to $U(x, z, p, y, c, \tau, \rho)$. As far as the fiscal parameters are concerned, this stipulation amounts to the not wholly unrealistic assumption that the subject is indifferent between tax-increments under which he contributes the same proportion of the total tax revenue. This, however, does not mean that he does not prefer some 'tax-regime' $\tau = \arctan(1/T)$ over others, nor does it imply that these preferences do not effect the relevant conditional goods preferences. Indeed, such an effect can very easily be modelled. Let τ^* denote the 'fair' tax-regime, i.e., the tax-regime under which the subject believes to contribute his fair share of the total tax collected. Accordingly he may well bear a grudge if his proportion is higher (if $\tau > \tau^*$) and be gleeful if it is lower ($\tau < \tau^*$), sentiments which could easily influence his preferences.[36] Indeed, a very simple way of modelling such a sensitivity to the perceived fairness of the payment vehicle is by means of the following conditional utility functions:

$$u_\tau(x, z) = \begin{cases} \alpha x \cdot (\beta z + \phi_\tau) & \text{if } \tau > \tau^* \\ \alpha x \cdot \beta z & \text{if } \tau = \tau^* \\ (\alpha x + \phi_\tau) \cdot \beta z & \text{if } \tau < \tau^* \end{cases} \qquad \text{with } \phi_\tau = \gamma |\tau - \tau^*|, \quad \alpha, \beta, \gamma > 0$$

As illustrated in Fig. 6, the consumer's surplus value of the increment from z^0 to z^1 under a begrudged tax regime (Fig. 6 b) will be less than the value under the fair regime (Fig. 6 a), which, in turn, will be less than the value the subject would attach to this increase if he felt gleeful about the amount of taxes he is paying. As in our initial discussion of the workings of GCS-instruments, the fundamental question in the context of such an extended instrument would have to be whether we can justifiably associate or identify one of these values with the trade-off value to be 'measured'. Again I can only suggest on heuristic grounds that the most likely candidate would seem to be the value elicited if the tax-regime is considered to be fair. Whatever the case might be, one practical consequence of this has to be that this type of extended survey must

[36] 'Fairness', or rather 'perceived fairness' of taxation is, of course, not just a matter of the proportion of the total tax-revenue the subject is paying, but for the present, purely illustrative purposes, there is no harm in adopting this simplified conception.

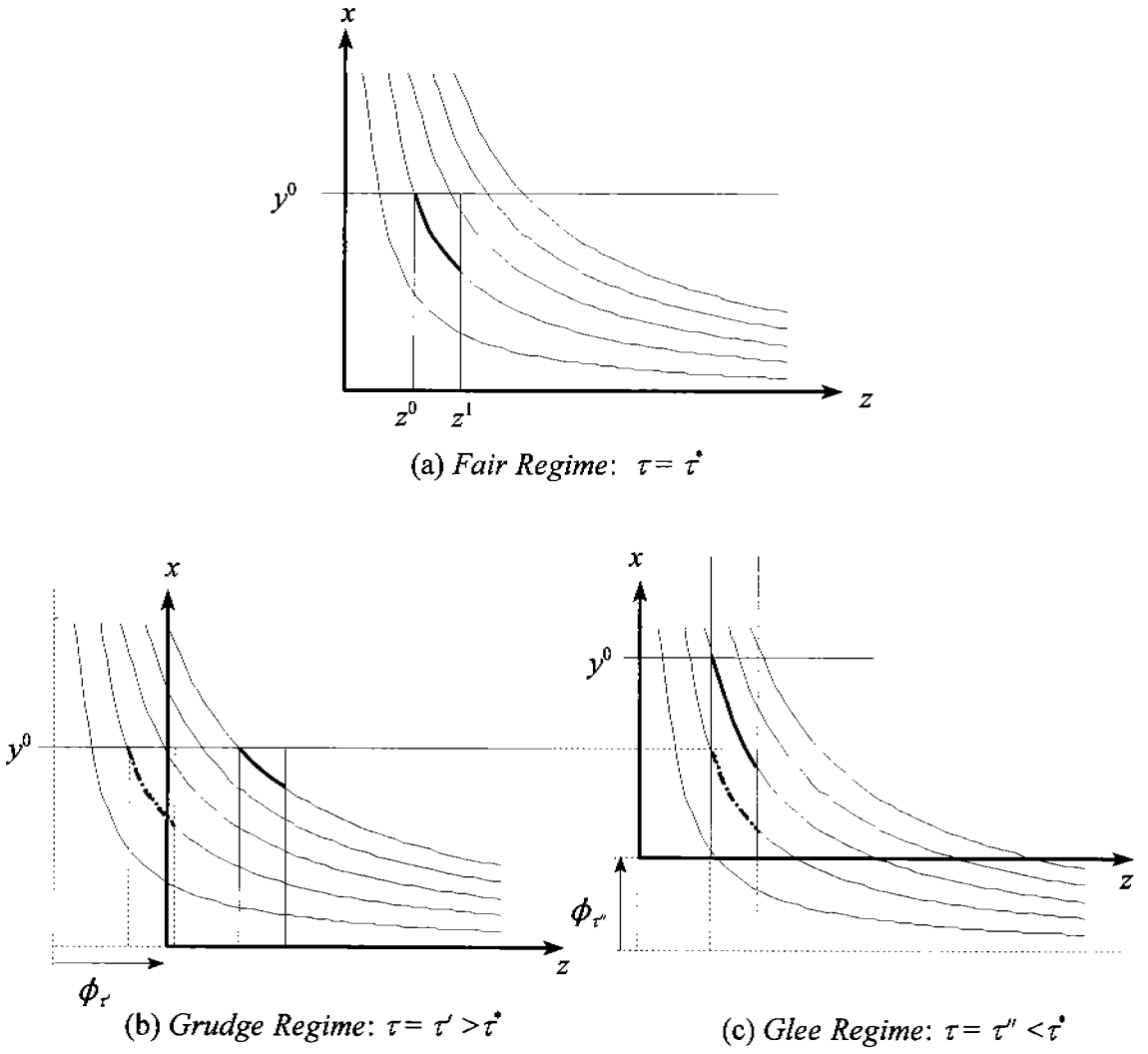

Fig. 6: *Sensitivity to Fairness*

establish the subject's attitude towards the payment vehicle, if it is to deliver valid estimates of the value *of the good* at all.[37]

[37] This means, in particular, that the Panel's list of items that would be helpful in interpreting the WTP responses, namely 'Income; Prior Knowledge of the Site; Prior Interest in the Site; *Attitudes Toward the Environment*; *Attitudes Toward Big Business*; Distance to the Site; Understanding of the Task; Belief in the Scenarios; Ability/Willingness to Perform the Task.'[Arrow *et al.*(1993): 4609; added emphasis] must be amended with 'Attitudes Toward the Payment Vehicle'. Although the survey administered by Carson *et al.* can be interpreted as addressing one fairness issue, namely whether Exxon itself should pay (part of) the cost [Carson *et al.*: 3/58], it contains, as far as I am aware, no such evaluation of the respondent's attitudes towards his income tax commitments.

5. THE ROLE OF INFORMATION IN CVs

While agreeing with the point made in Robert Mitchell and Richard Carson's seminal (1989) account of CVs that this sensitivity to fairness may be not only benign, but unavoidable, *if* the object is to estimate the value of a *policy*,[38] I fundamentally disagree with their conception of the role of information provided in CV surveys:

> From the researcher's point of view, CV scenarios contain two kinds of materials, those intended to be valuation-relevant and those intended to be valuation-neutral. The valuation-relevant elements are those the researcher wants the respondent to take into account in valuing the good –especially the description of the good and its provision. The remainder of the materials in the scenario are intended to convey a credible market for the good without affecting the WTP amount.[39]

> The researcher conducting a contingent valuation survey faces the task of obtaining relevant preferences from the respondent. Misspecification occurs when the respondent incorrectly (from the standpoint of theory or policy) perceives one or more aspects of the contingent market and the good to be valued. [...] What can loosely be called *methodological misspecifications* result when the market described by the researcher is formally correct, but one or more elements are inadequately communicated so that the respondent does not perceive them in the way intended by the researcher.[40]

> Bias will result if the respondent does not correctly perceive the scenario element as intended and if the misperception has a directional effect. For example, a researcher who uses a property tax payment vehicle may intend it to be a neutral form of payment, whereas the respondents, because they believe strongly that their property taxes are excessive, might react by expressing lower WTP amounts for the good than they otherwise would have been willing to pay.[41]

My own view is that if information is given to subjects then it is they and they alone who decide on the effect of this information on their decisions. In other words, the researcher may well intend some of his scenario prescriptions – say, an identification of a stated cost as the production cost – to be such 'neutral' information. But this simply means that he presupposes the subject to have a specific type of preferences, i.e.,, in our example, that he presupposes the separability we discussed in Section 3. Whether or not the subjects' preferences conform to this assumption is

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[38] 'The payment vehicle should be neutral with respect to the good unless the researcher intends to value a policy which is linked to a particular payment vehicle. [... If] taxes are used as a payment vehicle the researcher should be aware that negative feelings about such taxes may strongly influence the resulting WTP amounts. If the vehicle does influence the WTP amounts, it is the policy, rather than the public good independent of the payment mechanism, which is valued.'[Mitchell and Carson (1989): 221 f.]

[39] Mitchell and Carson (1989): 216 f.

[40] Ibid.: 246.

[41] Ibid.: 247.

a matter the researcher will have to ascertain empirically. What definitely is not the case is the subject being guilty of some sort of misinterpretation ('misperception') of the scenario element in question. Thus, as far as the provision of information which is meant to be 'neutral' is concerned, the researcher faces the following options: (i) he can choose to include the information, in which case he will have to check whether his preference assumptions are indeed satisfied and exclude all the elicited values in which they are not, or (ii) he can choose not to include the information in the first place.[42] Thus, if one does choose to include information about the way in which the amenity is to be provided and the way in which this provision is to be financed, we should indeed not be surprised to find with Arrow and Daniel Kahneman that this information does affect the WTP figures.[43] However, one will also have to keep in mind that – as pointed out repeatedly by Peter Diamond[44] – such values cannot be used for the purpose of establishing compensatory damages.

So why, if we *are* interested in establishing compensatory damages – i.e., the value of the public good, as opposed to that of a policy generating it – can we not simply omit any reference to methods of provision and their financing? The standard reason, I believe, against such an omission would be that it leads to a lack of 'realism' in the scenario:

> Realism in a CV scenario concerns the degree to which the valuation situation is plausible and meaningful to the respondent in the way intended by the researcher. Rowe and Chestnut (1982: 70) concisely describe the characteristics of a good contingent valuation scenario:
> '[it] must be informative; clearly understood; realistic by relying upon established patterns of behavior and legal institutions; have uniform application to all respondents; and, hopefully, leave the respondent with a feeling that the situation and his responses are not only credible but important.'
> [...] A number of factors contribute to making a scenario realistic. An obvious one is the degree to which respondents are familiar with the key scenario elements before the interview. These elements are the good, the method by which the good will be provided, the levels of its provision, the elicitation framework, and the payment vehicle.[45]

It goes without saying that, as far as contexts involving public goods are concerned, we are most familiar with evaluating specific projects. Yet I do not believe that there is a categorical chasm

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[42] Indeed, to be sure that the subject, in the example, does not inadvertently link the stated cost with the production cost, he might even include an explicit denial of this link in the scenario.

[43] See Arrow (1986): 183 f., and Kahneman (1986): 193.

[44] See Diamond and Hausman (1994): 57, and Diamond (1996): 345.

[45] Mitchell and Carson (1989): 214.

between public goods and non-public goods which would prohibit us from relying on any other types of 'established patterns of behaviour'. Take the situation where, having read an article which explains the workings of some electronic gadget without mentioning a price, I ask myself – in the absence of any (non-trivial[46]) knowledge of the cost involved in producing it – how much I would maximally be willing to spend on such a gadget. If, as I contend, this pattern of behaviour is neither outlandishly idiosyncratic nor necessarily tied to market goods, then I cannot see why a CV scenario which avoids references to production should not be capable of fulfilling the above-mentioned realism-criterion.

[46] The 'trivial' knowledge here is simply that the production will, most probably, cost something.

6. CONCLUSIONS

The general challenge in designing a valuation instrument is not to construct something which comes close to a complete description of a (possible) state of affairs; it rather is (i) to determine a 'manageable'[47] collection of parameters which are deemed to be acceptable for the purpose,[48] and (ii) to protect the instrument from the interference of those which are not. Values determined in general consumer's surplus instruments, in particular, will by design be sensitive to parameters other than the target-good level,[49] namely those of *status quo* income and market-good prices. Consequently, their values can only be used for purposes where this sensitivity is acceptable, which seems to be the case both in the context of valuing (environmental) goods and in that of valuing policies for generating/producing them. However, there is, I have argued, another parameter — namely the cost of the target increment — occurring by design in general consumer's surplus instruments, a sensitivity to which may be acceptable in the latter context, but certainly not in that of valuing goods *per se*. Being interested in valuing goods to establish compensatory damages, the safest option is to use to use a zero-cost instrument. For this the cost-parameter must be presented in its 'minimal' guise as a pure consumption cost. Otherwise, to link the cost-parameter to the production of the good will simply increase the possibility of unacceptable sensitivities, and thus biases. The main empirical question remaining has to be whether subjects will generally be able to form (stable) preferences based on this 'minimal' type of information. This is why, if I were asked for the ingredients of a research agenda, my suggestion would be to free some of the resources currently used on intricate econometric statistical investigations in order to procure a large dose of cognitive psychology to tell us about the preconditions for successful preference formation, and to add a modicum of philosophy, dealing with the normative issues concerning the acceptability of preference parameters.

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[47] By this I mean that they jointly can be subject to preferences, i.e., that the subject is capable to form the relevant preferences.

[48] The acceptability of a parameter depends on what the resulting values are meant to be used for.

[49] The fact that a value's sensitivity to this target-good parameter is to be considered not only acceptable but mandatory is, of course, the crux of the whole 'embedding' debate, a survey of which can be found in Müller (1996).

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