Does the knowledge of the origin of the health damage matter for WTP estimates ?

Anne Rozan* & Marc Willinger*

Abstract :

In this paper, we show that expressed willingness-to-pay (WTP) for reducing symptoms caused by air pollution, crucially depends on the respondents being aware of the origin of the symptoms. We observe that the average stated WTP is 50 % higher when respondents are informed in the questionnaire that air pollution is the origin of the bad health state. Since the information about the origin of the improvement of the health state is not neutral with respect to the valuation exercise, we discuss the relative merits of the two alternative methods : providing the information about the origin of the health improvement or not. We argue in favour of the alternative that provides that information. Indeed, without the information provided in the questionnaire, there is a risk that the valuation is based on individual information and subjective references. On the contrary, with the information, all willingness-to-pay are focused on the same cause, providing a better control over individual responses.

Résumé :

Le consentement à payer (CAP) pour une réduction de symptômes induits par la pollution atmosphérique est fonction de la connaissance des agents sur l'origine des symptômes. Ainsi, nous montrons que le CAP peut être plus élevé de 50% dans le cas où le répondant est informé sur l'origine des symptômes. Etant établi que l'information sur l'origine de l'amélioration de l'état de santé n'est pas neutre en matière d'évaluation, nous discutons de l'intérêt des deux méthodes alternatives. Nous argumentons en faveur de l'approche qui fournit l'information, car tous les agents sont concentrés sur la même cause, permettant ainsi un meilleur contrôle des réponses individuelles. A l'inverse, si l'information sur l'origine des symptômes n'est pas explicitement donnée aux répondants, ces derniers se basent sur une information privée.

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* BETA, Université Louis Pasteur
38 Boulevard d'Anvers, BP 1032/F 67070 Strasbourg Cedex.
Tél 03.88.41.52.18. Fax 03.61.37.66.
E-mail : rozan@cournot.u-strasbg.fr, willma@cournot.u-strasbg.fr

1. Introduction

Expressed WTP depends on how much information is provided to the respondent and on the knowledge that he has about the good to be valued (Whitehead et al. [1995], Halvorsen [1996]). In this paper we are interested in both the quantity and the type of information to be provided to the respondent in the questionnaire. In many CV studies, the analyst has often quite a large choice concerning the information to be provided in a questionnaire. In the specific case of valuation of health improvement due to the reduction of air pollution there are two main alternatives. For the first one, the information about the origin of the health improvement is not provided to the respondents. They simply state their WTP for a given improvement of their health status. The second alternative provides respondents with information about the origin of the improvement of their health status before the evaluation question.

From a theoretical point of view, there is no reason to expect a difference between the expressed WTP by the two alternative methods, since only consequences affect utility knowledge of the cause is irrelevant. Moreover, even if WTP can differ with respect to the available information, it is unclear in which direction additional information does affect the stated amount. Therefore, both approaches can be (and have been in the CV literature) used indifferently. However, we show that in the specific context of health improvements caused by reductions in air pollution, a significant difference is observed. The average stated WTP is 50 % higher when respondents are aware that pollution is the origin of the bad health state. Moreover, the information provided about the origin of the improvement is not neutral with respect to WTP but affects significantly the respondent's valuation. An important question is therefore, which of the two alternatives should be recommended. We argue that the alternative that provides information about the origin is preferable because informational differences and subjective references are reduced because respondents rely on the same cause. This provides a better control over individual responses.

The purpose of this paper is to investigate the extent to which additional information about the origin of a qualitative or quantitative change of the object to be valued, affects the WTP statement of the respondents. We designed several hypothetical questionnaires that have been submitted to samples of a given population in order to identify and to assess the effect of

additional information on the stated WTP. The paper is organised as follows : section 2 presents the theoretical foundations for WTP statements. Section 3 introduces a general theoretical framework of the link between WTP and available information. Section 4 describes the questionnaire design. Section 5 presents the results of the questionnaires, and section 6 concludes with the implications for CV design.

2. Theoretical framework

The contingent valuation method elicits the respondents' willingness to pay (WTP) for an improvement of the quality of the good being evaluated. Let us assume to simplify that the agent expects a health improvement with certainty. WTP is the outcome of a trade-off between the health improvement and the income reduction that the agent will face if he accepts to pay his share of the cost of the health improvement program. The stated WTP depends therefore on the proposed improvement, the respondents' personal characteristics, his income and his information about the good. In this section we introduce a simple model which derives the respondents' WTP (2.1) and describes the implication for value elicitation in the case of health benefits (2.2).

2.1 WTP for a quality improvement under certainty

Let the respondents' preferences be represented by a utility function *u(x,h)*, where *x* is a vector of private goods, and *h* an index of the agent's health status. Although *h* is usually a vector of variables, for simplicity we shall assume that health is represented by an index number. Utility is strictly increasing with consumption and health status ($\frac{\partial u}{\partial x_i} > 0 \forall i, \frac{\partial \mathrm{u}}{\partial \mathrm{h}} > 0$). Let us consider the situation where the current level of health is h_1. Health can be increased to h_2 with a policy program ($h_2 > h_1$), leading to the utility level $u(x, h_2) > u(x, h_1)$. Let $v(y, p, h)$ represent the indirect utility function, where *y* is the agent's income and *p* the price vector for the market goods. We assume that prices do not change over the period, so that we simply drop the prices in the indirect utility function. The agent is willing to accept a decrease in his income for the improvement in health from level h_1 to level h_2. Since we consider an increase in *h*, we measure the agent's WTP by the compensating surplus. The maximum amount of

income the agent is willing to give up for obtaining the health level h_2 (CS) is a solution of $v(y,h_1) = v(y-CS,h_2)$. For given x^* (optimal) CS is the loss of income which leaves the agent indifferent between the (x^*, h_1) and (x^*, h_2).

WTP depends on the environmental quality and on the level of income. In general it depends also on the price vector. Of course, empirically WTP is also depending on the characteristics of the respondent (education, gender, age, …). In the model, we assume that these data are already incorporated in the agent's utility function. Now let us assume that we provide the agent with additional information about the origin of the health improvement. According to the standard approach this additional information should not change the agent's WTP, since it is irrelevant for evaluating the health improvement. Let e be an externality variable that affects health, e.g. air pollution. Instead of giving information about h to the agent, we give now information about the function $h(e)$, with $h'(e) < 0$. Health improvement is now linked to a decrease in the externality e, from level e_1 to the level e_2, such as : $h_1 = h(e_1) < h(e_2) = h_2$. Specifying the argument e in the health status variable does not change the agent's evaluation.

However, several reasons could explain the difference between the WTP expressed when h is provided and the WTP expressed when $h(e)$ is provided. e may enter the utility function directly, because the externality affects not only the agent's health status, but also his utility. In this case the direct utility function is written $u(x, e, h(e))$. From a "consequentialist" point of view a change in health status due to an improvement of air quality can differ from the same change in health status due to another cause. "Being ill" and "being ill because of air pollution" are two different consequences. More generally, the consequences of different causes, even if they lead exactly to the same effect, are considered as different in this approach. For a consequentialist an agent may therefore attach a greater value when the health improvement is due to a reduction in air pollution than when it is due to some other cause, even if air pollution does not enter his utility function directly.

2.2. Implication for estimations of health benefits

In this section we apply the two approaches to the valuation of health benefits. After presenting these two approaches (cf. figure 1) which are commonly used in the literature, we shall discuss their respective implications.

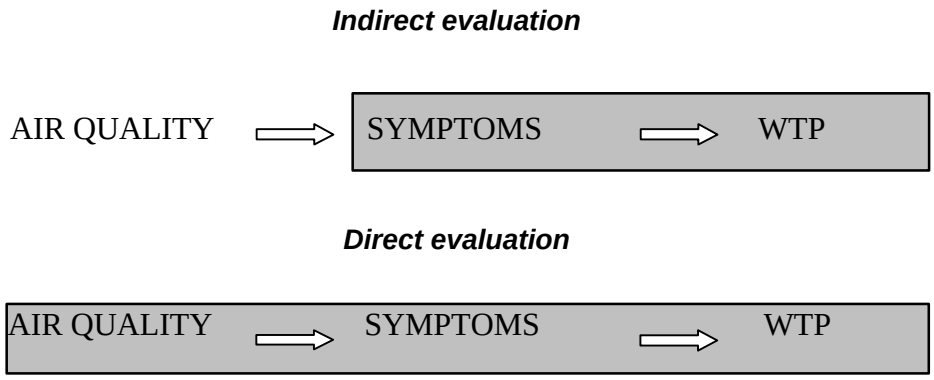

Figure 1 : Two approaches for eliciting the health benefits of an improvement in Air Quality

The first approach, "indirect evaluation" is built in two successive steps. In the first step, the WTP for a health improvement programme is elicited separately by the contingent survey. In the second step, the stated WTP is combined with the estimated dose-response functions (obtained from medical survey) in order to measure the benefit of an improvement in air quality. Alberini and al. [1994] adopted this approach in their study about health impacts of air pollution in Taïwan. The second approach, that we call "direct evaluation", involves only a single step. WTP for an improvement in the health state is elicited on the basis of information about the dose-response function provided to the respondent in the questionnaire. The respondent has a precise information about the origin of the health improvement when he answers the valuation question. Therefore he evaluates directly the benefit of an improvement of his health state due to improved air quality. A good illustration of this approach is given in the study of Farber & Rambaldi [1993].

An important empirical question is to know whether the two approaches lead to the same WTP estimates or not. If estimates differ it is important to know to what extent and in which direction does the information about the origin of the health improvement influence the respondent's WTP. According to Rowe and Chesnut [1985] :

« *As long as individuals do not value differently the same health impact caused by different sources, the effort to quantify and value air pollution health impacts can proceed as two independent tasks in the damage function approach.* » (page 2-2).

If the WTP obtained in the direct evaluation is significantly different from the WTP of the indirect evaluation, given the additional information on the dose-response function provided in the questionnaire, a further question arises : which one of the two approaches must be recommended to CV practitioners ?

3. Information and stated WTP

We assume that when he answers a WTP question, a respondent relies both on his own knowledge as well as on the information provided by the questionnaire. Observed differences in stated WTP reflect differences in respondents characteristics (age, gender, profession, etc.) and in respondents behaviours with respect to the valuation question, as well as differences in privately available information about the good to be valued. Although most individual characteristics can be observed, it is usually difficult to observe the respondent's level and quality of privately owned information about the situation.

We shall assume that expressed WTP depends on the quality or quantity change of the good to be valued[1] (Δq), the respondents' income (y) and the personal characteristics of the respondent (s)[2]. Furthermore, WTP depends also on the information about the good that is provided in the questionnaire ($\{Iq\}$) as well as prior private information held by each respondent individually ($\{Ip\}$) before the CV questionnaire, and which varies from respondent to respondent. The information sets $\{Iq\}$ and $\{Ip\}$ generally include many different variables. In the case where Δq is an improvement in the respondent's health status, the information set $\{Iq\}$ may include the results of a recent epidemiological study and the set $\{Ip\}$ may include the knowledge that air pollution induce an increase in attack of asthma of the respondent's children.

$$WTP = WTP (\Delta q, y, s, \{Iq\}, \{Ip\})$$

[1] For instance, air quality, groundwater quality or quantity of angler or hunter permits
[2] In case of a referendum survey, one should else add the bid level.

How the respondent reacts with respect to the additional information provided in the questionnaire, {Iq}, depends on how this additional information is aggregated by the respondent. Several possibilities may arise :

- The additional information is irrelevant to the respondent. The respondents' mental accounting is not influenced by any additional information provided in the questionnaire. In this case, his WTP will not be affected by {Iq}.
- The information provided in the questionnaire is redundant with the private information of the respondent ($\{Ip\} \supseteq \{Iq\}$), in which case {Iq} does not affect his WTP. For example, if the respondent knows already that 75% percent of his headaches are due to air pollution, his WTP will be unaffected by providing that additional information in the questionnaire.
- If $\{Ip\} \subset \{Iq\}$, the additional information provided in the questionnaire increases the available information of the respondent for assessing his WTP.. This would presumably lead to more reliable WTP statements. For example, Poe & Bishop [1993] showed that additional information increased WTP for maintaining groundwater quality.

Whitehead et al. [1995] give a nice illustration of the different cases described above. They tested the reliability of WTP statements for preserving water quality for three different categories of respondents : users who have had previous experience with the good, "off-site" users who only have theoretical knowledge about the good but do not use it effectively, and non-users who are not informed at all about the good. The stated WTP for users and "off-site" users passed the reliability test but not for non-users.[3] This study suggests that experience and knowledge of the good to be valued is an important factor affecting the reliability of WTP estimates.

When the additional information {Iq} is about the origin of the quantity or quality change (Δq), the evaluation process is the same. If there are several possible causes, as in the case of illness, respondents may rely on one or several of them, in a way that is unknown and

[3] The reliability test compared responses to a WTP question with responses to a question that elicited the "worth" of the resource. Contrary to a WTP question, the "worth" question is not related to a payment vehicle. Therefore, the worth should be larger than the WTP. A weak test of the alternative form of reliability of WTP is the correlation between "worth" and WTP. A stronger test of reliability is the correlation plus a difference in means test.

uncontrolled by the CV practitioner. Each respondent might therefore implicitly rely on a different reference combination and hierarchy of causes, which is unknown to the survey designer. For example, in a survey where respondents are asked about their WTP for reducing the probability to be killed in road accidents, they might take into account different background informations which interfere with their valuation. Some respondents may think of accidents caused by people who are driving too fast, others of accidents provoked by alcoholic drivers, some others of accidents due to bad visibility, and some others of some complex mixture of different causes. For a given respondent, the expressed WTP may therefore differ according to the cause of accident he has precisely in mind upon answering the questionnaire. If he relies, for example, on alcoholic people or on fast driving, he may express a stronger WTP than if he relies on traffic density. Indeed, he may believe that alcohol consumption and respect of speed limits can be better controlled than traffic density. On the other hand, if he relies on “visibility”, he might express a lower WTP, because it is a seasonal cause of accidents, that he considers to be negligible or a fatality. We think that questionnaires should be designed in a way that identifies clearly the cause that motivates the study, in the case where several causes might account for Δq, or when there is ambiguity about that cause. The aim is to minimise the variance in expressed WTP that is caused by information differences within the sample of respondents. We believe that more accurate and more reliable WTP statements are obtained if information differences can be controlled and reduced.

The implication for CV survey is to provide enough information to minimise prior information differences between respondents. Prior information differences could be assessed in preliminary survey, using for example verbal protocols. The aim is to reinforce {Iq}, which is the information provided by the questionnaire, in order to decrease the "relative weight" of the private information ({Ip}) in the total available information. The more information provided by the questionnaire, the lower the number of respondents who will rely only on their own private information. Therefore, we think that providing more information, will lead to more focused and more reliable WTP statements.

In the rest of the paper we provide evidence that supports the hypothesis that additional information about the cause has a significant impact on the respondents’ WTP. In the light of the results of our experimental questionnaires, our hypothesis seems to be validated : additional information about the cause has an impact on WTP valuation. However,

the impact of additional information does not seem to be clearly predictable. In some cases information about the cause increases the respondent's WTP, whereas in some other cases, we observe the opposite effect.

4. Questionnaire design

4.1 Procedure

In order to test our hypothesis, we designed hypothetical choice questionnaires that were administered to samples of students. These questionnaires were submitted between January and April 1998 at the University of Strasbourg. Each questionnaire presented a version of a scenario describing a quality improvement program. Several versions were proposed. One of them, the **reference version**, was used as a basis of comparison for other versions, that we shall call **test versions**. In the reference version of the scenario the origin of the improvement was not provided, while the origin was explicit in the test versions. We shall describe these versions in more detail below.

Our results are based on a between-subject comparison as well as a within-subject comparison. In the between-subjects comparisons, we are interested in the magnitude of the difference in mean WTP measures obtained for each version. For the between-subject comparison each respondent answered a single version of the questionnaire (the reference version or one of the two test versions). In the within-subjects comparisons, subjects were faced with the two versions of the questionnaire in sequence : they first answered the reference version and then one of the test versions. We are interested in the frequency and direction of the revision of the stated WTP between the two versions of the scenario.

Two different types of scenarios were submitted :[4] the first one is about a health improvement program, and the second is reducing risk of being killed in a road accident. The scenarios are detailed below. We used a payment card for the elicitation format (note that the questionnaire is read by the respondents). However, in order to test the influence of the

[4] For building our scenarii, we related on the studies of Alberini and al. [1994] and Desaigues and Rabl [1995].

elicitation format, we also realised several within-subjects experiments using a close-ended question format.

4.2. Scenarios

4.2.1. The health improvement scenario

Subjects were given a short questionnaire describing a public health programme that would reduce by 30% the occurrence of symptoms (such as headache, eye irritation, sore throat...). Obviously, subjects who had in mind the link between air pollution and symptoms when answering the reference version were not likely to revise their WTP statement in the test version. On the other hand, subjects who ignored or did not think about this link were likely to revise their WTP, although the direction of change could be either way. Indeed, even if some subjects might be concerned about air quality and its relation to health, others may think that they are not responsible for air pollution, or that they do not want to pay for it even if it does improve their health status with a positive probability. We introduced also a scenario presenting a second cause (pollen and dust mites), in order to test whether the WTP difference between the reference scenario and the test scenario is due to the knowledge of the cause as such or rather to the nature of the cause (see Appendix 1 for the three versions of the health questionnaire).

4.2.2. The accident reduction scenario

The accident reduction scenarios are constructed on the same principles as the health improvement scenarios. The reference version proposes a road safety program whose purpose is to reduce the number of death from road accidents. The two other versions inform the respondent on the causes that induced the death. The first test version introduces alcohol and the second one introduces visibility (lack of light, dangerous cross-roads...). The two causes were selected to be as close as possible from the two causes in the health scenario in order to increase the efficiency of the comparison. One cause could be considered by the respondent as a negative externality (pollution or alcohol), the second one is more neutral (pollen or dust mites and visibility). The accident questionnaire is presented in Appendix 2.

5. Results

We tested the hypothesis that knowledge of the origin of the improvement does not affect the subject's WTP, both with a between-subject comparison and a within-subject comparison. For the between-subject test we compared the mean WTP obtained for groups of subjects which answered different versions of the questionnaire. In the case of the within-subject test, each subject was asked to state his WTP twice : first without knowing the cause, and second after the cause was given in the questionnaire.

5.1. Between-subjects comparison

Subjects were randomly assigned to one of the versions of the questionnaire (with the information about the cause or without). For each group we calculated the average WTP, and calculated the relative difference in WTP between two versions. Table 1 summarises the results. The first column indicates the scenario. The second indicates the different versions or treatments. Column 3 is the sample size, column 4 the mean WTP and column 5 shows the gap between the mean of the no-cause treatment and the mean of the cause treatment (in % of the mean WTP of the "no cause" treatment).

Scenario	Version	n	Mean	Gap
Health	No cause	59	121 F	
	Pollution	57	173 F	+ 43%
	Pollen	58	101 F	- 16%
Accident	No cause	43	173 F	
	Alcohol	43	149 F	- 16%
	Visibility	43	142 F	- 22%

Table 1 : Between subject comparison

In Table 1, the pollution version for the health scenario is the only case for which the mean WTP is larger than the relevant no-cause version. All other versions have a lower mean WTP than the reference version. Table 2 shows the test results. The null hypothesis of equality of means is rejected for the comparisons between the "pollution version" and the two

other versions at the 1% significance level. For the accident scenario we cannot reject H_0 although the knowledge of the cause seems to have a negative effect on the mean WTP.

Scenario	Test	Result	Level
Health	No cause / Pollution	H_0 rejected	1%
	No cause / Pollen	H_0 accepted	77%
	Pollution / Pollen	H_0 rejected	1%
Accident	No cause / Alcohol	H_0 accepted	74%
	No cause / Visibility	H_0 accepted	79%
	Alcohol / Visibility	H_0 accepted	60%

Table 2 : Test results for the comparison of the different scenarios

The comparisons show that additional information about the cause does significantly affect the expressed WTP in the health scenario. While knowledge of the cause has an impact on the mean WTP in the health scenario, one cannot conclude whether it is the knowledge of the cause or it's nature which matters. Subjects are willing to pay more when the origin of the health improvement is due to pollution and less when it is due to pollen, in comparison to the reference situation (no cause).

5.2. The within-subjects results

The within subject test was realised on groups of subjects that were presented either the “Health scenario” or the “Accident scenario”. Each questionnaires was divided into two stages. In stage one, each subject was asked to state his WTP for the proposed improvement, without reference to a specific cause. In stage 2, the information about the cause was provided, and the same question was asked again. Each group of subjects was further divided in subgroups confronted to different versions of the cause-treatment. Table 3 summarises the data of the different groups and subgroups.

Scenario	n	Version	Mean	Version	Mean	Gap
Health	26	No cause	123 F	Pollution	180 F	+ 45 %
	26	No cause	82 F	Pollen	81 F	0 %
Accident	26	No cause	230 F	Alcohol	209 F	- 10%
	24	No cause	127 F	Visibility	144 F	+ 13%

Table 3 : General results of within subjects

There is a large gap between the no-cause treatment and the pollution treatment for the health scenario. For the accident scenario, there is a substantial gap with the alcohol treatment and with the visibility one. However, in the latter, the knowledge about the cause does not have the same influence. The cause about pollen seems to have no effect on the subjects' WTP.

To test these differences, we state as the null hypothesis (H_0) that the information on the origin of the improvement has no impact on the WTP. Let us write :

H_0 : WTP("no cause")=WTP("cause")

The alternative hypothesis (H_1) is that the information about the origin leads to a significant revision of the subject's WTP. Table 4 shows the results of the Wilcoxon signed ranks test, which is the relevant test for our matched paired data.

Scenario	**Cause**	**n**	**Result**	**level**
Health	Pollution	26	H_0 rejected	1 %
	Pollen,dust mites	26	H_0 accepted	55%
Accident	Alcohol	26	H_0 rejected	1%
	Visibility	24	H_0 accepted	73%

Table 4 : Results of the Wilcoxon signed ranks test

In two cases we observe a significant revision of the stated WTP : the health scenario with air pollution and the accident scenario with alcohol. In the two other cases, the subjects did not significantly revise their WTP. Accordingly, it seems that it is rather the nature of the cause (pollution or alcohol) which matters than the knowledge of the cause as such. It is noteworthy that the cause "alcohol" affects negatively the stated WTP while the cause "pollution" leads to a positive revision instead. Indeed, one could have expected a bias towards upwards revision, on the ground that respondents are committed to their initial response, and are therefore reluctant to adjust downward. Obviously, this is not the case when respondents know that the reduction of road accidents is due to alcohol control.

It is also remarkable that only the two causes that correspond to a negative externality (pollution and alcohol) lead to significant revisions of WTP. This tends to support the hypothesis that the respondent does not simply take into account the consequence. However it

is not obvious to predict if the knowledge of the cause will affect the respondent's WTP or not, and if it does, in which direction. For example, for the alcohol version, people who are very sensitive to the problem would accept to pay more, while others may want to decrease their WTP, because they had in mind another reason than alcohol which is more important to them. Still some others may think that a program cannot resolve this type of problem or consider that it is an individual problem, for which they do not want to pay.

We further tested whether the elicitation format may affect the observed differences in WTP between the various versions. In order to test the impact of the elicitation format, we collected WTP data on a separate group on the basis of a referendum question. In the health scenario, a contribution level equal to 300 FF was proposed for the health improvement programme, while in the accident scenario the contribution level was set equal to 200 FF. Table 5 shows the results of the within-subjects comparison of the referendum format. The table shows the observed results (sample size, mean, gap) as well as the test results (Wilcoxon signed ranks test). The results are in accordance with the results obtained with the payment card although only the null hypothesis of identical means were rejected for the pollution treatment in the health scenario. Moreover, the gap is smaller in the case of the referendum elicitation method. This can be explained by a strong anchoring effect on the proposed contribution level (300F for the health scenario and 200F for the accident scenario).

Scenario	Version	n	Mean	Gap	Result	level
Health	No cause	19	95			
	Pollution	10	125	+ 39%	H_0 rejected	5%
	Pollen	9	125	+ 25%	H_0 accepted	
Accident	No cause	22	202			
	Alcohol	11	264	+ 31%	H_0 accepted	
	Visibility	11	177	- 12%	H_0 accepted	

Table 5 : Results of within subjects with referendum question format

6. Discussion

Our results demonstrate that any additional information may significantly affect the respondents' WTP (between 20 and 50% increase or decrease). As described previously, this information concerns the cause of a quality change of the good under consideration.

Several cases were encountered depending on the private information Ip and the additional information provided in the questionnaire Iq. If Iq is redundant for Ip there is no difference in the WTP statement. However, if Ip and Iq differ and if Iq is relevant, the WTP statement can be either smaller or larger depending on the kind of questionnaires used. One must therefore raise the question : "which scenario should be used and under what circumstances ?"

The question becomes crucial when contingent valuation is used in a cost-benefit analysis. Indeed, depending on which scenario is used, the decision-maker can be led to totally different conclusions. For instance, the authorities could decide not to start a program because the estimated benefits are not sufficient for justifying the cost.

Let us consider again the case of the health benefits generated by an improvement in air quality. A critical point should first be stated : WTP statements are more accurate, more controllable and more reliable if all respondents have access to the same information. Actually, the fact that the respondent revises his first WTP shows that the information provided in the questionnaire does affect his WTP. A respondent who does not receive additional information relies on his own private information. As long as the researcher has not a complete knowledge of the respondent's background, he will be unable to observe or measure the information used to state the WTP. This raises problems for interpreting the results as well as for aggregating WTP. Verbal protocols (see Schkade, Payne [1993]) can help the researcher to check if all respondents understand the questions and rely on the same knowledge when they state their WTP.

In the field of health damage evaluation, the current practice favours the use of indirect evaluation, i.e. without additional information about the cause. These studies try to avoid the embedding effect. According to Navrud [1998] :

> « by not giving the respondents any information about the "program" that would make it possible to buy yourself free from the symptoms, we avoid that respondents include their value of avoiding other impacts from air pollution in their symptoms values. » (page 9).

The argument is, if respondent are given information about pollution, they would assess the decrease in the level of pollution rather than the improvement in their health state (for instance, the effect of air pollution on plants or building...). However, embedding can still

arise even if the cause is not explicit in the questionnaire. There is no guarantee that respondents do not evaluate a cause, or several ones, if there is no explicit one which is mentioned in the questionnaire. The CV practitioner may incorrectly believe that embedding is controlled for, without taking the necessary precautions to avoid it effectively.

An increase in the WTP resulting from the knowledge of the cause may be defensible. For instance, the WTP for an improvement in health state may be larger if a link between the symptoms and the air pollution is evidenced. Indeed, air pollution could be regarded by the respondent as a negative externality. That is to say that the discomfort is greater in this case : having symptoms may be regarded as the fault of fatality, having symptoms because of air pollution is more frustrating. As we measure psychological costs, the cost of suffering from pollution symptoms must also be valued.

Given that contingent valuation results are also used in the perspective of benefits transfer, the scenario with additional information seems also more accurate. Indeed, contingent surveys cannot be realised in all cities, since they are costly and time consuming. As long as the problem is common to several cities, the results can be applied to the whole country. This is the case for urban air pollution which is common to all large cities among the same country. Hence, more informed respondents give more accurate and more reliable WTP statements, which provide better benefit estimates. However, context-dependent valuation is often seen as an obstacle to transferability.

Some authors think that the advantage with the indirect approach is that WTP for health can be potentially for any cost benefit analyses (i.e. symptoms from tobacco, from air pollution etc.). But, in the light of our results, this transferability property is not validated. If the knowledge of the cause has an impact on the WTP statement, there is no reason to use the same estimation for different policies.

Thus, with respect to this discussion, the direct evaluation approach, which provides additional information appears more defensible. The more precise the information provided by the questionnaire, the more focused WTP statements will be. The additional information plays an important role. Halvorsen [1996] suggests the same idea in a sequential valuation procedure. For her, the main reason for the bias she observed (ordering effect and/or part-

whole biases) « seems to be that the respondents are given imperfect information about the valuation problem during the valuation sequence » (page 497). Even though the additional information was not about the cause, it affected the respondents' WTP, because it was given step by step, instead of being given at once.

Finally, our results are consistent with those of Smith [1996], that is to say that stated choices as part of a contingent valuation survey discriminate between significant and trivial causes.

References

Arrow K., Solow R., Portney P.R., Leamer E.E., Radner R., Schuman H., 1993, "Report of the NOAA Panel on Contingent Valuation", 64 pages.

Alberini A., Cropper M., Fu Tsu-Tan, Krupnick A., Liu Jin-Tan, Shaw D., Harrington W., 1994, "Valuing Health effects of Air Pollution in developing countries: The case of Taiwan", 33 pages.

Cummings R.G., Brookshire D.S., Schulze W.D., 1986, "Valuing environmental goods. An assessment of the contingent valuation method", Rowman & Allenheld publishers, 270 pages.

CVM Network, Kriström B., 1991-1992, EDS. Handelshogskolan I. Stockholm, Stockholm School of Economics.

Desaigues B., Point P., 1993, Economie du Patrimoine Naturel: la valorisation des bénéfices de protection de l'environnement, Economica, 317 pages.

Desaigues B., Rabl A., 1995, "Reference value for human life: An econometric analysis of a contingent valuation in France", in Contingent Valuation, Transport Safety and the Value of life, Schwab Christe N.G.& Soguel N.C. editors, Kluwer Academic Publishers, pp.85-112.

Farber S., Rambaldi A., 1993, "WTP for Air Quality : The case of Outdoor Exercice", Contemporary Policy Issues, 11, 4, pp.19-30.

Halvorsen B., 1996, "Ordering effects in contingent valuation surveys : Willingness to pay for reduced health damage from air pollution", Environmental and Resource Economics, 8, pp.485-499.

Hoehn J.P., Randall A., 1989, "Too many proposals pass the benefit cost test", The Amercian Economic Review, 79, pp.544-551.

Mac Fadden D., 1994, “Contingent Valuation and Social Choice”, American Journal of Agricultural Economic, 76, pp.689-708.

Mead W.J., 1993, “Review and analysis of state-of-the art contingent valuation studies”, in Contingent valuation : A critical assessment, J.A. Hausman (editor), Elsevier Science Publisher B.V., pp.304-327.

Mitchell R.C., Carson R.T., 1989, Using surveys to value public good: the contingent valuation method, Resources for the Future, the Johns Hopkins University, Washington, 463 pages.

Navrud S., 1998, “Valuing health impacts from air pollution in Europe, New empirical evidence on morbidity”, Mimeo, Agricultural University of Norway, 24 pages.

Poe G.L., Bishop R.C., 1993, “Information, risk perceptions, and contingent values for groundwater protection”, Center for integrated agricultural systems, University of Wisconsin, College of agriculture and life sciences, Cornell University, pp. 27-53.

Rowe R.D., Chesnut L.G., 1985, “Oxydants and Asthmatics in Los Angeles : A Benefit Analysis”, EPA - 230 - 07 - 85 - 010.

Schkade D.A., Payne J.W., 1993, “Where do the numbers come from ? How people respond to contingent valuation”, in Contingent Valuation : A critical assessment, J.A. Hausman editor, pp.271-304.

Sen A., 1977, “Social choice theory : a re-examination”, Econometrica, 45, pp.53-89.

Siegel S., Castellan N.J.Jr, 1988, “Nonparametric statistics for the behavioral sciences”, Mac Graw-Hill internationa editions, 399 pages.

Smith V.K., 1996, “Can contingent valuation distinguish economic values for different public goods”, Land Economics, 72, 2, pp.139-151.

USEPA, 1997, “The benefits and costs of the Clean Air Act, 1970 to 1990”, Draft Report, 18-juil., 451 pages, EE-0295, Washington D.C.

Willinger M.,1996, “La méthode d’évaluation contingente : de l’observation à la construction des valeurs de préservation”, Natures, Sciences et Sociétés, 4, 1, pp.6-22.

Withehead J., Blomquist G., Hoban T., Clifford W., 1995, “Assessing the validity and reliability of contingent values : a comparison on On-Site Users, Off-Site Users, and Non-Users”, Journal of Environmental Economics and Management, 29, pp.238-251.

Appendix 1 : The health state improvement scenario

Question 1 and question 2 are just relevant for the within-subject experiments. In the between-subject one, respondents answer just one question, question 1 corresponds to the version 1. The beginning of the scenario is always the same for all versions. These comments hold for the second scenario presented in Appendix 2.

Question 1 :

Recent national and international studies have shown that the risk to catch some benign illness (such as headache, runny nose, sore throat, eye irritation....) has increased for the whole population, since 1985, between 30 and 40%.

A prevention programme could bring this risk back to the 1985 level.

What are you willing to pay to participate in this programme which will last 5 years ?

Please circle your choice, it is a yearly contribution in Francs.

0	10	20	30	40	50	100	150	200	
250	300	350	400	500	600	700	800	900	1000

Question 2

Version 2

Epidemiological studies have shown that air pollution causes part of these symptoms.

Version 3

Epidemiological studies have shown that pollen and dust mites cause part of these symptoms.

Appendix 2 : The accident reduction scenario

Question 1 :

Recent national studies have shown that, in 1996, the consequences of road accidents amounted to 8000 death casualties. This number has been decreasing since 1995. A road safety programme could reduce it even more. This programme could reduce the number of death casualties a thousand over 2 years.

What are you willing to pay to participate in this programme which will last 2 years ?

Please circle your choice, it is a yearly contribution in Francs.

0	10	20	30	40	50	100	150	200	
250	300	350	400	500	600	700	800	900	1000

Question 2

Version 2

In fact, 30% of death casualties are caused by alcohol. The safety road programme consists in fighting against alcohol.

Version 3

In fact, 30% of death casualties are caused by poor visibility (lack of light, dangerous cross-road...). The safety road programme consists in improving visibility.

Appendix 3 : The Wilcoxon-Man-Whitney test

Group	Scenario	Elicit Format	Result
Group A	Health	Referendum	H_0 accepted
Group C	Health	Card	H_0 accepted
Group D	Accident	Referendum	H_0 rejected at 1% level
Group E	Accident	Card	H_0 accepted