Monetary Valuation of Environmental Goods: Alternatives to Contingent Valuation

Baarsma, B.E.

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Chapter 5
The IJburg Experiment:
CVM versus Conjoint Measurement

"A referendum on IJburg means that we have to make a choice between two stacks of hay: a sheet of water mirrored in the sun, with only the spritsail of a tjalk in sight under a flight of cormorants on their way to Naardermeer, and young families seeking the bliss of a home in a spacious and light environment, yet close to the city."
(J. Jansen van Galen, in: Projectbureau IJburg, 1996a)\(^1\)

IJburg is a future new residential quarter in Amsterdam, to be built on artificial islands in the IJmeer (a lake east of Amsterdam). The quarter will contain 18,000 dwellings, the first of which will be completed in 2001. Since not everybody was in favour of the plan (as the quote conveys), the question whether or not IJburg should be built was the subject of a referendum in March of 1997. The referendum entailed a large amount of information on IJburg. Indeed, it imposed so much details, facts and news that some people did not know what to think anymore, and some were even 'IJburg-sick'. Anyhow, during the first few months of 1997 the subject was very much a hot issue in Amsterdam.

Because of the topicality, the extensiveness of the information available to the public and the reality of the questions surrounding the project, IJburg was a pre-eminently suitable subject for a valuation study. As a PhD student I felt it would be very instructive to do the construction of the questionnaire, the fieldwork and the analysis myself instead of contracting the work out to others. And indeed, I have learnt a lot, among other things, that doing such a survey entails an enormous amount of work.\(^2\)
5.1 Introduction

In the first week of February, 1997, a sample of 1,204 persons of that part of the population of Amsterdam entitled to vote, received a survey containing –among other things– valuation questions. The sample was drawn from a database provided by the Dutch Post Office (PTT). Respondents were requested to return the completed surveys before March 15, 1997, as the actual referendum was to be held on March 19. Half of the respondents in the sample received a contingent valuation variant of the survey, the other half received a conjoint measurement variant. One of the aims of the study is to inquire into the differences between the results of the contingent valuation method (CVM) versus those of the conjoint measurement (CM).

Apart from this more theoretical aim of the study, the results in terms of the willingness to pay (WTP) are relevant as well. For instance, it is interesting to compare the amounts resulting from the survey with the sums that the authorities have appropriated to compensate for the losses due to the construction of IJburg. The total budget for IJburg amounts to f6 billion. It covers the construction of the artificial islands and the public transport as well as part of the costs of the housing facilities. According to the project planners (Projectbureau IJburg, 1997a), the costs of mitigating activities with respect to nature conservation and recreation amount to f36 million and f65 million, respectively.

In short, ‘the good’ that is under valuation encompasses the values of the recreation and natural areas of that part of the IJmeer that is lost if the residential area IJburg is built. To compensate for these lost values, a hypothetical ‘IJmeer Fund’ is created in the survey. This Fund pays for the construction of alternative scenic, wildlife and recreation areas. Although the IJmeer Fund is merely a hypothetical idea, plans to create alternative areas to compensate for the loss of nature and recreation values do actually exist. However, the fact that a real fund exists, is purely coincidental and has nothing to do whatsoever with our survey. The provincial authorities created this fund in January 1997, after consultations with advocates and opponents of IJburg. Contributors to the real fund include the province of North-Holland, the municipality of Amsterdam and the ‘Vereniging Natuurmonumenten’ (a private environmental organization). They agreed to contribute some f5 million each, which adds to some f15 million.

The survey asks for the individual WTP for the IJmeer Fund. The CVM survey poses a dichotomous choice question: “Are you or are you not willing to pay f x for the IJmeer Fund?”. If the answer is no, respondents have the opportunity to specify a bid that is acceptable to them. In the CM survey respondents are asked to rank 6 different, but
similar situations (called 'vignettes') from most preferred to least preferred. Subsequently, CM respondents are asked to give each vignette a report mark (from 0 to 10), and to state whether they think the vignettes are acceptable. Each vignette contains three attributes: one for nature, one for recreation and one for a monetary contribution to the IJmeer Fund. In the CVM survey, the WTP is directly clear from the answer to the valuation question. However, when using the CM data, the WTP has to be retrieved indirectly from the rank order, the report marks and/or the acceptability of the vignettes.

5.2 Hypotheses

As was mentioned earlier, the aim of the survey is to inquire into the differences between the contingent valuation method and conjoint measurement. In order to get an understanding of these differences, several hypotheses are formulated. The idea behind these hypotheses is:

Conjoint measurement is at least as useful as the contingent valuation method when pricing environmental goods.

Two kinds of hypotheses are now formulated. Hypotheses I and II are specifically aimed at investigating the above stated idea about CM. On the other hand, hypotheses III to V are of a more general kind, and are common in the valuation literature.

Hypothesis I
Respondents find it easier and more acceptable to give an order of alternatives (a relative valuation, as in CM) than to state an absolute number (as in the CVM).

This hypothesis can be tested by studying response behaviour, like for instance the non-response rates (section 5.5) and the rate of protest voters (section 5.11.2). Presumably, these rates will be higher in the CVM variant than in the CM variant.

Hypothesis II
The results of the contingent valuation method are comparable to the results of conjoint measurement.

Hypothesis II can be tested by comparing the results of the CVM survey with the answers of CM respondents to the so-called CVM-vignette. Every respondent in the CM experiment receives such a CVM-vignette. This is a vignette with exactly the same
information as the respondent in the CVM survey has to evaluate: the loss of recreation and nature values will be fully compensated (e.g., no over- or undercompensation and the monetary contribution to the Fund is the same). Since respondents evaluate exactly the same good, it is possible to examine the differences between the monetary results of the two methods. This will be done in section 5.11.3.

We now turn to the hypotheses with a more general character.

**Hypothesis III**
Order effects are not present in the questionnaire. This means that the sequence of answer categories does not have an unintentional effect on the answers given by a respondent.

Since five different versions of the survey were constructed with different orders of the answer categories in questions 1 and 4, order effects can be tested for. If the survey is sensitive to order effects, the answers to questions 1 and 4 should differ significantly between these five versions. Section 5.8 deals with this issue.

**Hypothesis IV**
Non-use values related to IJburg or the IJmeer are positive. This indicates that people who do not currently use IJburg or the IJmeer to live, recreate or enjoy nature, and do not intend to do so in the future, have a positive valuation for the IJmeer Fund.

The survey asks respondents whether they are (potential) users or non-users of IJburg. Therefore, it is possible to determine non-use values, at least for the CVM respondents (cf. section 5.9.1).

**Hypothesis V**
The contingent valuation elicitation method ("Are you willing to pay \( fx? \)\)) introduces a starting-point bias.

In each of the five versions of the questionnaire a different starting-point \( x \) is included in the question "Are you willing to pay \( fx\)?". Starting-point bias is tested for in section 5.9.3, by comparing the valuations stated by the CVM respondents over these five versions.
5.3 Referendum IJburg

Referenda are a new phenomenon in the Netherlands. Since 1992, several referenda were organized in Amsterdam: plans for less traffic in the city centre (1992, turnout of 28%), a new provincial zoning plan (called ‘ROA’) and the building on a pasture called ‘de Vrije Geer’ (simultaneously held in 1995, turnout of 40%), a new underground line between the North and the South of Amsterdam (1997, turnout of 22%). In March 1997 the referendum about the question whether or not IJburg should be built, was held.

The campaigns of both the advocates and the opponents of IJburg have been fierce. Unprecedentedly fierce by Dutch and Amsterdam standards, even to the extent that one might be tempted to speak of ‘American scenes’. Apart from the usual campaign materials, like information magazines, pamphlets and meetings, unusual means were put into action. The municipality of Amsterdam, i.e. the Projectbureau, organized an exposition with a scale-model of IJburg. Also, the Projectbureau distributed small stickers depicting the slogan ‘Yes to IJburg’ along with the suggestion to put them on coins. This caused much commotion, since it is forbidden by law to stick anything on coins. Opponents of IJburg distributed free postcards. Both groups used boat trips on the IJmeer, commercials on radio and TV, and outdoor advertising in their campaigns. Local television broadcaster AT5 spent quite a lot of time on the subject, i.e., in the form of a special daily IJburg newscast. In regional as well as national newspapers, IJburg was a hot topic too. Lastly, one week before the referendum, a special newspaper with information about IJburg (the pros and the cons) was distributed to all Amsterdam citizens.

The fieldwork for the study in hand was done in February and the first part of March of 1997. This was just at the time when the campaign was at its fiercest and the dissemination of information was large. The survey kind of free-rode on this information flow and campaign fever. This background formed an excellent soil to conduct a mail survey: more expensive alternatives, like telephone or in-person surveys, were not necessary. In fact, a telephone survey was not even an option since respondents have to consider visually a series of vignettes which cannot be dealt with by phone. According to some scientists, in-person interviews give the best results, since complex scenarios can be explained, visual aids can be used and the problems relating to missing data can be prevented (Mitchell and Carson, 1989). However, mail surveys do have advantages of their own, apart from the financial arguments. One advantage is that the greater sense of anonymity obtained with mail questionnaires leads to greater frankness on sensitive issues. Furthermore, interviewer bias is less likely to occur.
And, finally, mail surveys can be answered in a place and at a pace that is convenient to the respondent.

In this particular case, even more arguments in favour of a mail survey existed. Due to the vast amount of information already available to the public, the amount of information in the survey could be limited to fit into a relatively short written questionnaire. We felt that the minimum response rate of 30% could be achieved without having to work with reminders. The subject was, after all, very much alive in Amsterdam.

The rules of the game in the referendum were as follows. The municipality of Amsterdam wins the referendum (and is thus entitled to built IJburg) if:

1. more votes to “IJburg Yes” were received than votes to “Stop IJburg”;
2. a minimum of 154,935 opponents would cast in favour of “Stop IJburg”.

The required number of 154,935 opponents equals half of the people who voted in the last municipal election of 1994 plus one. The city council set this requirement in 1996, after they had lost the previous two referenda in 1995. Since the old rules were much more favourable for the opposition (only 92,000 advocates were required to stop IJburg), the opponents of IJburg tried to change the new rules in court. However, they did not succeed and the new rules were pronounced valid.

Although the people of Amsterdam are not the only ones that will be affected by IJburg, they were the only ones entitled to vote in the referendum. That is why the sample for the survey was taken from the part of the population of Amsterdam, who are entitled to vote, which are 558,809 people. The results of the referendum are presented in table 5.1. Under the new rules, the opposition has lost the referendum, since they did not amount to the required 154,935. However, under the old rules they would have won.

Table 5.1 also features the results of some pre-election polls and the survey. In June, 1996, the Amsterdam citizens’ familiarity with IJburg was already 70%. At the time of the referendum this percentage had risen considerably: according to the survey, almost every citizen had heard of or read about IJburg. From the polls and the survey, it is obvious that quite some people (15 to 16%) doubted even close to the referendum date, whether they would vote for or against the project.
Table 5.1: Results of pre-election polls, the referendum and the survey

<table>
<thead>
<tr>
<th></th>
<th>Pre-election poll 7/95</th>
<th>Pre-election poll 6/96</th>
<th>Pre-election poll 17/3/97</th>
<th>Referendum of 19/3/97</th>
<th>Survey (3/2/97-15/3/97)</th>
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<tbody>
<tr>
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<td>Total sample N=410</td>
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<td>CM version N=219</td>
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<td></td>
<td></td>
<td>CVM version N=191</td>
</tr>
<tr>
<td>Familiarity with IJburg</td>
<td>-</td>
<td>70%</td>
<td>-</td>
<td>-</td>
<td>98.5%</td>
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<td>99.1%</td>
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<td>97.9%</td>
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<td>(404)</td>
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<td>(217)</td>
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<td>(187)</td>
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<tr>
<td>Advocates</td>
<td>28%</td>
<td>36%</td>
<td>34%</td>
<td>41.5%</td>
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<td>93,199</td>
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<td>29.5%</td>
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<td>121</td>
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<td>26.9%</td>
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<td>(59)</td>
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<td></td>
<td>(62)</td>
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<tr>
<td>Opponents</td>
<td>30%</td>
<td>23%</td>
<td>50%</td>
<td>58.0%</td>
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<td>130,199</td>
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<td>55.1%</td>
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<td>(226)</td>
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<td>58.4%</td>
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<td>51.3%</td>
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<td></td>
<td></td>
<td>(98)</td>
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<tr>
<td>Don’t know/ Don’t care</td>
<td>42%</td>
<td>41%</td>
<td>16%</td>
<td>-</td>
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<td>15.4%</td>
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<td>(63)</td>
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<td>14.6%</td>
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<td>(32)</td>
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<td>16.2%</td>
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<td>(31)</td>
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<tr>
<td>Turnout</td>
<td>-</td>
<td>-</td>
<td>60%</td>
<td>40.2%</td>
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<td></td>
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<td></td>
<td>(224,478)</td>
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<td>-</td>
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</tbody>
</table>

(\ldots) number of voters

1 Source: Trendbox/Projectbureau IJburg.

2 Source: Choice/AT5 text 18/3/97.

3 Sources: Parool 20/3/97, Volkskrant 20/3/97.

4 The percentages of advocates and opponents are taken from the number of people who voted (224,478).

5 The percentage related to the turnout is taken from the total population entitled to vote (558,809).

With the figures from table 5.1 it is possible to test whether there is a difference between the percentages of advocates and opponents in the survey and in the referendum? Since the "don’t know" category was not an option in the referendum, it is impossible to compare survey results with the actual referendum. Therefore, the survey results are compared with the pre-election poll of 17/3/97, using a $\chi^2$-test as reviewed in i.e. Freund (1979, pp. 315-317). The percentages may be regarded as equal at a 5% significance level ($\chi^2 = 4.857$, which does not lie in the critical region $\chi^2 > 5.991$).

The survey was completed by 410 respondents, of which 219 filled out the CM variant and 191 the CVM variant. The results of the CVM and CM variants of the survey are similar: opponents form a majority with 51% (CVM) to 58% (CM) and advocates a minority with 27% (CM) to 33% (CVM), while the rest did not know what they would vote. Again using a $\chi^2$-test, the hypothesis is tested that these percentages of opponents, advocates and "don’t knows" of the CM and CVM subsamples are equal. It follows that the percentages do not differ significantly at a 5% level ($\chi^2 = 4.187$). This is an important observation because any differences between the two subsamples are apparently not caused by different attitudes towards IJburg.
5.4 Construction of the Questionnaire

A first concept version of the questionnaire was constructed on the basis of literature on the subject of IJburg, examples of similar valuation questionnaires and consultations with IJburg-experts (Van Beek, 1993; Carson et al., 1992; and see background information on IJburg). Next, ten colleagues looked closely at the questionnaire and checked whether it exhibited any inconsistencies, spelling errors, strange questions or suggestive information. After revision of the first concept, a second concept version was distributed among students and co-workers within the university complex, with the request to complete the questionnaire along with comments and questions about obscurities. Finally, a third concept version was handed out to passers-by in the street, which they could fill out either on the spot, or at home. Twenty-five questionnaires were distributed (13 of the CM variant and 12 of the CVM variant), all of which were returned (one CM survey uncompleted). Respondents appeared to have understood the questions very well, and it was not necessary to drastically change the questionnaire.

All respondents to either the CVM or the CM survey received the same questions, except for the valuation question, which will be discussed below. Section 5.4.1 deals with the contingent valuation questions, and section 5.4.2 with the conjoint measurement questions. The complete questionnaire is included in appendix I at the end of this book.

5.4.1 Construction of the Contingent Valuation Question

In the CVM variant, respondents are asked to express their willingness to pay in a direct way. The question format is the dichotomous choice format, with the possibility of an open answer: a respondent says ‘yes’ or ‘no’ to a certain bid $f_x$ (contribution to ‘IJmeer Fund’) and is given the opportunity to fill in another bid if $f_x$ is conceived as either too high or too low. If respondents are willing to pay less than $f_x$, or if they do not know how much to contribute, they are asked for their motivations in question 8 or 9. The “don’t know” category is added to the answers because of the recommendation of the NOAA panel.\(^6\)

In the CVM variant, each of the 5 versions has a different starting-point of the contribution: $f_{2.50}$, $f_{5}$, $f_{10}$, $f_{15}$, or $f_{25}$. Moreover, the answer categories of question 8 and 9 alternate to correct for possible order effects. Below the contingent valuation question of version 3 is shown.
question 7
Some people say they are willing to contribute f10 to the 'Umee Fund', others are willing to pay more, while still others are willing to pay less. Would you be willing to contribute f10, more than f10, or less than f10 to the 'Umee Fund'? Please keep in mind your income and other expenses.

- about f10 
- more than f10, viz. f......
- less than f10, viz. f......
- don't know

→ go to question 10
→ go to question 10
→ go to question 8
→ go to question 9

question 8
You are willing to pay less than f10 to the 'Umee Fund'. For what reason?

- I cannot afford it
- it is not worth that much to me
- others should pay for it
- different reason, viz.

→ go to question 10
→ go to question 10
→ go to question 8
→ go to question 9

question 9
You are not sure how much you would contribute to 'Umee Fund'. Why not?

- I am not sure whether my household can afford such a sum
- insufficient information
- the decision is not mine to make
- I am not sure how much it is worth to me
- different reason, namely

→ go to question 10
→ go to question 10
→ go to question 8
→ go to question 9

5.4.2 Construction of the Conjoint Measurement Question

In the CM variant, the willingness to contribute to the IJmeer Fund is not asked in a direct way, but is inferred from the rank order, the report marks and/or the acceptability of the vignettes. Every CM questionnaire contains 6 vignettes (or situations), with 3 attributes each (cf. table 5.2). The first attribute is nature, which can take on 4 different values; the second attribute is recreation with 5 different values; and the third attribute is a one-time contribution to the IJmeer Fund, which can take on 5 different values.

Table 5.2: Three attributes and their possible values

<table>
<thead>
<tr>
<th>Nature</th>
<th>Recreation</th>
<th>One-time contribution</th>
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</thead>
<tbody>
<tr>
<td>25% increase</td>
<td>25% increase</td>
<td>f 2.50</td>
</tr>
<tr>
<td>remain the same</td>
<td>10% increase</td>
<td>f 5</td>
</tr>
<tr>
<td>25% decrease</td>
<td>remain the same</td>
<td>f 10</td>
</tr>
<tr>
<td>50% decrease</td>
<td>10% decrease</td>
<td>f 15</td>
</tr>
<tr>
<td></td>
<td>25% decrease</td>
<td>f 25</td>
</tr>
</tbody>
</table>
With these attributes and values it would be possible to construct $4^*5^*5$ (=100) vignettes. However, the vignettes in which both nature and recreation are negative are disposed of, since these are not realistic, given the fact that the information in the survey and the media suggests that the loss of nature and recreation values will at least be compensated for. Consequently, 80 realistic vignettes remain. Other conditions that had to be met when constructing the vignettes, include:

- Each version has to contain one 'CVM-vignette' (the attributes nature and recreation both have the value 'remain the same'). The reason for this is to increase the comparability to the CVM questionnaire (after all, in the CVM questions it is assumed that nature and recreation are fully compensated ('remain the same') when IJburg is constructed).
- 30 versions of 6 vignettes are required.
- The levels of the attributes have to be chosen in such a way that the set of vignettes is approximately orthogonal (cf. chapter 4, section 4.2). This implies that no correlation or collinearity exists between the attributes. In this study, the set of vignettes is approximately orthogonal.

So, we need to fill 180 positions (30 versions of 6 vignettes equals 180). If each version has to contain one CVM-vignette, and if 5 possible CVM-vignettes exist, each CVM-vignette appears in 6 versions (that is: the required 30 versions divided by 5). The first six versions contain the CVM-vignette with a contribution of $f2.50$, the second 6 contain the CVM-vignette with $f5$, and so on, until the last six versions which contain the CVM-vignette with $f25$. With these CVM-vignettes, $5^*6$ (=30) positions of the 180 positions are already taken. Except for the CVM-vignettes, 75 realistic vignettes exist (80 minus the 5 CVM-vignettes), that can be spread over the remaining 150 (180 minus 30) positions. So, every vignette appears twice (150 divided by 75).

The exact wordings of the vignettes question are given below. Question 7 asks respondents to rank the six vignettes presented to them in the questionnaire from most preferred to least preferred. Apart from the order of the vignettes, the respondents are asked to give each vignette a report mark in question 8. This question also serves to let respondents rethink the rank order of the vignettes. Finally, the respondents are asked which of the six vignettes are acceptable to them (question 9).
question 7
Below you find 6 different situations concerning the new green and recreation areas in and around the IJmeer, and concerning the individual contributions to the IJmeer Fund. If you were asked to arrange these situations hierarchically, from best to worst, which situation would you put first (that is: the best situation), which one would you put second (that is: the second best situation), et cetera, up till and including the situation that you would put in the sixth place (the worst situation).

<table>
<thead>
<tr>
<th>Situation 1</th>
<th>Situation 2</th>
<th>Situation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature: the quantity of plants and animals in the IJmeer decreases by 25%</td>
<td>Nature: the quantity of plants and animals in the IJmeer remains the same</td>
<td>Nature: the quantity of plants and animals in the IJmeer decreases by 25%</td>
</tr>
<tr>
<td>Recreation: the possibilities for water sports and other forms of recreation remain the same</td>
<td>Recreation: the possibilities for water sports and other forms of recreation remain the same</td>
<td>Recreation: the possibilities for water sports and other forms of recreation increase by 25%</td>
</tr>
<tr>
<td>one-time contribution: f15</td>
<td>one-time contribution: f2.50</td>
<td>one-time contribution: f25</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Situation 4</th>
<th>Situation 5</th>
<th>Situation 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature: the quantity of plants and animals in the IJmeer increases by 25%</td>
<td>Nature: the quantity of plants and animals in the IJmeer decreases by 50%</td>
<td>Nature: the quantity of plants and animals in the IJmeer remains the same</td>
</tr>
<tr>
<td>Recreation: the possibilities for water sports and other forms of recreation increase by 10%</td>
<td>Recreation: the possibilities for water sports and other forms of recreation increase by 10%</td>
<td>Recreation: the possibilities for water sports and other forms of recreation decrease by 25%</td>
</tr>
<tr>
<td>one-time contribution: f5</td>
<td>one-time contribution: f10</td>
<td>one-time contribution: f25</td>
</tr>
</tbody>
</table>

Please indicate your ordering of the six situations below. Consider the various situations well and keep in mind your income and other expenses. (Please state the number of the situation of your choice on the dotted lines.)

- my first choice would be situation No. . . .
- my second choice would be situation No. . . .
- my third choice would be situation No. . . .
- my fourth choice would be situation No. . . .
- my fifth choice would be situation No. . . .
- my sixth choice would be situation No. . . .

question 8
Could you please give report marks (between 0 and 10) for each of the six situations, where 10 represents what you feel to be the best possible situation and 0 represents what you feel to be the worst possible situation. Your choices can get marks ranging from 0 to 10, and each subsequent choice gets a lower mark than did the previous one (the second choice gets a lower mark than does the first choice, the third choice gets a lower mark than does the second choice, and so on). Please give marks for each choice.

- first choice: mark . . .
- second choice: mark . . .
- third choice: mark . . .
- fourth choice: mark . . .
- fifth choice: mark . . .
- sixth choice: mark . . .

question 9
You have now ranked and graded the six different situations, but could you please also indicate the situation that is the most acceptable to you (meaning the situation that you would really be willing to pay for). Please cross one answer only.

- only the first choice
- the first and the second choice
- the first, second and third choice
- the first, second, third and fourth choice
- the first, second, third, fourth and fifth choice
- all six choices
- none of these choices
5.5 Response

The questionnaire was sent to a random sample of the population of Amsterdam of 18 year and older, which consists of 558,809 people. The sample size is 1,204. The sample was taken from the database of the PTT (which stands for the Dutch Post Office), based on the zip codes of the residents of Amsterdam. A summary of the response data is shown in table 5.3.

Table 5.3: Summary of response data

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Total sample</th>
<th>CM sample</th>
<th>CVM sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received before 20/3/97*</td>
<td>426</td>
<td>226</td>
<td>200</td>
</tr>
<tr>
<td>Received after 20/3/97</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Unit non-response</td>
<td>16</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>* due to removal of the respondent</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>* due to decease of the respondent</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>* reason unknown</td>
<td>13</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Item non-response</td>
<td>39</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>Net response</td>
<td>410</td>
<td>219</td>
<td>191</td>
</tr>
<tr>
<td>Response rate</td>
<td>34.1% (410/1204)</td>
<td>36.4% (219/602)</td>
<td>31.7% (191/602)</td>
</tr>
</tbody>
</table>

* Respondents were requested to send in their completed surveys before March 15, 1997. Surveys received after March 20, 1997, were excluded from the sample (this implies a margin of 5 days, including a weekend). This final date was set to prevent any influence from the results of the referendum (March 19) on the completion of the surveys.

Overall, and for a mail survey without reminders, the response rate (35.4% or 426/1204) is good. The more so if we take into account that, in the Netherlands, the non-response in surveys is known to be relatively high. On average 55% refuses to cooperate, while this percentage rises to 80 when politically sensitive subjects are involved, and IJburg is such a politically sensitive subject, as the fierce campaign has indicated (Volkskrant, 22/10/97). Many CVM researchers have recorded response rates as low as 25%, and 40 to 60% seems average for CVM mail surveys in the United States (Loomis, 1987). Arrow et al. (1993) state that non-response is unlikely to be below 20%, even in very high-quality surveys.

Response rates for the CM subsample are higher than for the CVM subsample, namely 36.4% (219/602) for the CM subsample against 31.7% (191/602) for the CVM subsample. Using a z-test (see for instance, Harnett, 1982, pp. 401-403), the hypothesis is tested that the response rates are equal. The computed value of the test
statistic $z_c$ is -1.7028. Consequently, the response rates are significantly different at a 8.9% level of significance.

From table 5.3 it is obvious that unit non-response (respondents who fail to respond to the whole questionnaire) is almost the same over the two subsamples (7 returned empty CM questionnaires, versus 9 empty CVM questionnaires).

Moreover, Arrow et al. (1993) claim that item non-response (some questions are not answered by some respondents) is also a large problem, particularly for the valuation questions. Researchers have found that non-response is often associated with a lack of interest in the survey topic, and that response rates typically vary across population subgroups. However, non-response can also be attributed to the fact that people have not yet formed their preferences when they are asked to participate in a valuation survey (in the terms of chapter 2 of this thesis: people do not have well-structured preferences for non-marketed environmental goods). This makes them hesitant, since they have to take much trouble and time over the construction of their preferences.

Table 5.4 describes the item non-response of the sample in more detail. The item non-responses do not differ very much either, at least in total figures (20 versus 19). However, if we study the item non-response more closely, we see that the response behaviour for the valuation questions in the two variants differs.

<table>
<thead>
<tr>
<th>Question</th>
<th>Total sample</th>
<th>CM sample</th>
<th>CVM sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Question 4</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Question 5</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Question 6</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CM valuation question:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 7 (ranking)</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Question 8 (report mark)</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Question 9 (acceptability)</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CVM valuation question:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 7 (WTP)</td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Question 13</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Question 17</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Question 18</td>
<td>7</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Question 24</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

Six out of the 191 CVM respondents did not answer question 7. Item non-response concerning the CM valuation question is not so clear-cut, since the valuation question
consists of three different parts: rank ordering (question 7), report marks (question 8) and acceptability (question 9). Only three out of the 219 CM respondents did not answer the rank ordering and acceptability questions. This is 50% less than the non-response to the valuation question in the CVM subsample. On the other hand, the non-response to the report mark question is considerably higher, namely 15, of whom 9 did not mark any of the vignettes and 6 did mark some, but not all, of the vignettes. Probably, this relatively large non-response is caused by the fact that people feel they are asked the same question again after fulfilling the ranking task.

**Consistency checks for CM answers**

As was mentioned in chapter 4, section 4.2.1, the purpose of asking a three-piece vignettes question, is that respondents are forced to reconsider their rank order when asked to mark each vignette, and to reconsider their ranks and marks again when asked the acceptability question. Apart from the fact that this procedure increases the reliability of the answers, the three answers can be compared and inconsistencies between the answers can be eliminated from the sample. Three consistency checks are possible:

1. Report marks have to imply the same rank ordering as the ranking question (inconsistency between rank order and report marks);
2. If a vignette ranked x is acceptable (x = 1,...,6), a vignette ranked x-1 cannot be unacceptable (inconsistency between rank order and acceptability);
3. If a vignette marked y-1 is acceptable (y = 1,...,10), a vignette marked y cannot be unacceptable (inconsistency between report marks and acceptability).

Out of the whole subsample of 219, only ten respondents gave inconsistent answers (4.6%). Eight of these cases were related to inconsistencies between rank order and report marks, and the remaining two cases were related to inconsistencies between report marks and acceptability. Apparently, a few respondents in this study are less accurate when it comes to filling in report marks, whereas they fulfil the ranking and acceptability tasks more carefully.\

**Conclusion**

On the basis of these figures and of the tables 5.3 and 5.4, it seems justified to support the hypothesis that respondents find it easier and more acceptable to answer indirect valuation questions, like the ranking of vignettes, than to answer such questions directly in the form of an absolute WTP. The reason is twofold:
1. Response rates are higher for the CM sample than for the CVM sample (36.4% versus 31.7%);
2. Non-response concerning the valuation questions is lower for CM respondents, that is, for two out of the three valuation questions in the CM survey (ranking and acceptability). For the report mark question the non-response is much higher, as is the rate of inconsistent behaviour, implying that a few people feel that they are asked the same question again after ranking the vignettes. In short, the response figures concerning the valuation questions are mixed, but do certainly not suggest that CVM outperforms CM.

This hypothesis will be considered in more detail later on in this chapter, in section 5.11.2.

5.6 Representativeness of the Sample

To examine the representativeness of the sample, certain statistics of the respondents (sample) will be compared with the values of these statistics in the Amsterdam population. The idea behind this exercise is that certain groups of respondents, for instance lower educated people, might be less interested in politics, or in nature, or in surveys in general. These groups will probably produce relatively little response. To correct for the potential under- or overrepresentation of particular groups, the response data of the group in question are reweighted.

Table 5.5 gives the percentages of certain groups in the sample as well as in the population.

In order to assess the representativeness, a $\chi^2$-test is performed to identify possible differences between these percentages. The marked percentages in table 5.5 differ on a 5% significance level.

It appears that the first category of the age characteristic is underrepresented in the sample. However, it is not worth the trouble to correct for this small part of the sample (i.e., the validity would not improve much). Since persons with the highest education are overrepresented in the sample and those with a lower level of education are underrepresented (as was to be expected), the mean income is significantly higher in the sample.\(^5\)
### Table 5.5: Comparison of sample and population characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Sample</th>
<th>Population(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>199 (48.5%)</td>
<td>364,694 (51.0%)</td>
</tr>
<tr>
<td>Male</td>
<td>211 (51.5%)</td>
<td>350,369 (49.0%)</td>
</tr>
<tr>
<td>Age(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-19</td>
<td>2 (0.5%)*</td>
<td>13,609 (2.3%)*</td>
</tr>
<tr>
<td>20-34</td>
<td>141 (34.4%)</td>
<td>215,071 (36.8%)</td>
</tr>
<tr>
<td>35-49</td>
<td>119 (29.0%)</td>
<td>167,905 (28.7%)</td>
</tr>
<tr>
<td>50-64</td>
<td>67 (16.3%)</td>
<td>94,322 (16.1%)</td>
</tr>
<tr>
<td>65 and older</td>
<td>81 (19.8%)</td>
<td>93,347 (16.0%)</td>
</tr>
<tr>
<td>Highest education(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>22 (5.4%)*</td>
<td>148,000 (27.5%)*</td>
</tr>
<tr>
<td>LBO/VBO</td>
<td>39 (9.5%)</td>
<td>64,000 (11.9%)</td>
</tr>
<tr>
<td>MAVO</td>
<td>25 (6.1%)*</td>
<td>64,000 (11.9%)</td>
</tr>
<tr>
<td>MBO</td>
<td>34 (8.3%)*</td>
<td>66,000 (12.3%)</td>
</tr>
<tr>
<td>Havo/VWO</td>
<td>47 (11.5%)</td>
<td>62,000 (11.5%)</td>
</tr>
<tr>
<td>HBO/WO</td>
<td>243 (59.3%)</td>
<td>134,000 (24.9%)*</td>
</tr>
<tr>
<td>Mean net monthly household income(5)</td>
<td>$3,641*</td>
<td>$2,550*</td>
</tr>
<tr>
<td>Mean % of registered people seeking a house(6)</td>
<td>54 (13.2%)</td>
<td>50,000 (12.8%)</td>
</tr>
<tr>
<td>Average number of cars per household(7)</td>
<td>0.507</td>
<td>0.538</td>
</tr>
</tbody>
</table>

* significantly different at a 5% level.


By reweighting the sample with regard to the education characteristics, the overrepresentation for income is also corrected for. The weighting factors (table 5.6) are calculated by taking the number of people according to the population statistics and dividing that number by the number of respondents in the sample.

### Table 5.6: Weighting factors for the characteristic ‘highest education’

<table>
<thead>
<tr>
<th>Characteristic highest education</th>
<th>Weighting factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary education</td>
<td>5.13</td>
</tr>
<tr>
<td>MAVO</td>
<td>1.95</td>
</tr>
<tr>
<td>MBO</td>
<td>1.48</td>
</tr>
<tr>
<td>HBO/WO</td>
<td>0.42</td>
</tr>
</tbody>
</table>

5.7 Differences between CM and CVM Subsamples

Since the aim of this research is to investigate whether the two methods, contingent valuation and conjoint measurement, give similar results, it is also very important to test whether the CM sample and the CVM sample consist of respondents with
approximately the same characteristics. If this would not be the case, differences in the results of the two methods could not solely be attributed to the methods but also to the underlying samples. Therefore, it is tested whether the characteristics can be considered equal.

### Table 5.7: Comparison of CM and CVM sample characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>CM</th>
<th>CVM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>113 (51.6%)</td>
<td>86 (45.0%)</td>
</tr>
<tr>
<td>Male</td>
<td>106 (48.4%)</td>
<td>105 (55.0%)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-19</td>
<td>2 (0.9%) *</td>
<td>0 (0%) *</td>
</tr>
<tr>
<td>20-34</td>
<td>72 (32.9%)</td>
<td>69 (36.1%)</td>
</tr>
<tr>
<td>35-49</td>
<td>72 (32.9%)</td>
<td>47 (24.6%)</td>
</tr>
<tr>
<td>50-64</td>
<td>35 (16.0%)</td>
<td>32 (16.8%)</td>
</tr>
<tr>
<td>65 and older</td>
<td>38 (17.4%)</td>
<td>43 (22.5%)</td>
</tr>
<tr>
<td><strong>Highest education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>13 (5.9%)</td>
<td>9 (4.7%)</td>
</tr>
<tr>
<td>LBO/VBO</td>
<td>20 (9.1%)</td>
<td>19 (9.9%)</td>
</tr>
<tr>
<td>Mavo</td>
<td>15 (6.8%)</td>
<td>10 (5.2%)</td>
</tr>
<tr>
<td>MBO</td>
<td>18 (8.2%)</td>
<td>16 (8.4%)</td>
</tr>
<tr>
<td>Havo/VWO</td>
<td>27 (12.3%)</td>
<td>20 (10.5%)</td>
</tr>
<tr>
<td>HBO/WO</td>
<td>126 (57.5%)</td>
<td>117 (61.3%)</td>
</tr>
<tr>
<td><strong>Mean net monthly household income</strong></td>
<td>f3,706</td>
<td>f3,565</td>
</tr>
<tr>
<td><strong>Mean % of registered people seeking a house</strong></td>
<td>29 (13.2%)</td>
<td>25 (13.1%)</td>
</tr>
<tr>
<td><strong>Average number of cars per household</strong></td>
<td>0.516</td>
<td>0.497</td>
</tr>
</tbody>
</table>

* significantly different at a 5% level.

Using the test statistic \( z \) in order to test for differences between sample percentages \( p \), it appears that the only characteristic that differs between the CM and the CVM samples is the youngest age group (marked with *).\(^1\) However, as was mentioned earlier, it is not worthwhile to correct for this small part of the sample.

A t-test on the difference between two means (see for instance, Harnett, 1982, pp. 378-381) is performed to test the hypothesis that the mean net monthly household income differs between the sample and the population. The t-value \( t_c \) is 0.701, which does not lie in the critical region. Hence the null hypothesis of no difference is accepted.

Apart from the comparison of the sample characteristics in the table above, it is important to check whether respondents in the subsamples share the same attitudes and opinions about certain matters. From section 5.3 and table 5.1 we already know that the attitudes towards the construction of IJburg (advocates versus opponents) do not differ significantly between the two subsamples.
Questions 5 and 6 in the survey consider yet another important attitude. The respondents are asked whether they consider it possible (question 5) or desirable (question 6) to compensate for the nature and recreation values that are lost because of the construction of IJburg. The answers to these questions could be “yes”, “no” or “don’t know”. The responses are presented in table 5.8. It is interesting to note that the majority of the respondents do not think that compensation of lost nature and recreation values is possible, while on the other hand 80% of them think that compensation is desirable.

Table 5.8: Comparison of CM and CVM answers to question 5 and 6

<table>
<thead>
<tr>
<th>Question 5</th>
<th>Total sample</th>
<th>CM</th>
<th>CVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensation is possible</td>
<td>132 (32.2%)</td>
<td>71 (32.4%)</td>
<td>61 (31.9%)</td>
</tr>
<tr>
<td>Compensation is not possible</td>
<td>217 (52.9%)</td>
<td>120 (54.8%)</td>
<td>97 (50.8%)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>60 (14.6%)</td>
<td>28 (12.8%)</td>
<td>32 (16.8%)</td>
</tr>
<tr>
<td>Non-response</td>
<td>1 (0.2%)</td>
<td>-</td>
<td>1 (0.5%)</td>
</tr>
<tr>
<td>Question 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compensation is desirable</td>
<td>329 (80.2%)</td>
<td>178 (81.3%)</td>
<td>151 (79.1%)</td>
</tr>
<tr>
<td>Compensation is not desirable</td>
<td>43 (10.5%)</td>
<td>26 (11.9%)</td>
<td>17 (8.9%)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>32 (7.8%)</td>
<td>12 (5.5%)</td>
<td>20 (10.5%)</td>
</tr>
<tr>
<td>Non-response</td>
<td>6 (1.5%)</td>
<td>3 (1.4%)</td>
<td>3 (1.6%)</td>
</tr>
</tbody>
</table>

A z-test is used to test whether the percentages differ between the CVM and the CM sample. It appears that these percentages do not differ on a 5% significance level.

5.8 Order Effects

One potential bias often described in the contingent valuation literature is the so-called question order effect. These effects show up when the sequence of questions or the sequence of answer categories, which should not have any effect, do have an effect on a respondent’s answer.

To test for the order effects the answer categories of the questions 1 and 4 were put in different orders. Five versions exist, each with a particular order of answer categories. If order effects are present, the answers differ between these versions. We first look at question 1.
Question 1

In the Netherlands we are faced with various problems. Several of these problems are mentioned below. Please indicate for each problem whether we should spend more, less, or exactly as much as we are currently spending on it in the Netherlands.

(Please, circle your choice for each issue)

<table>
<thead>
<tr>
<th>Problem</th>
<th>More</th>
<th>The Same</th>
<th>Less</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fighting unemployment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Development aid</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>The issue of immigration</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fighting congestion</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fighting crime</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fighting the housing shortage</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Protecting the environment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Improving education</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Table 5.9 below gives the percentages of the respondents who would like to distribute more, the same amount or less money to the various categories (also a "don’t know" option exists). For instance, 47.5% of the respondents who received version 1 (78 respondents in total received version 1), is convinced that we should spend more on fighting unemployment.

These order effects are tested for by using a $\chi^2$-test with the null hypothesis that the percentages for a certain category (like 'fighting crime') are the same for each answer possibility (like 'more money') over the five versions. If these percentages differ significantly, order effects prevail ($H_a$).

$H_0$: $P_{\text{version 1}} = P_{\text{version 2}} = P_{\text{version 3}} = P_{\text{version 4}} = P_{\text{version 5}} = P_{\text{mean all versions}}$

$H_a$: $P_{\text{version 1}} \neq P_{\text{version 2}} \neq P_{\text{version 3}} \neq P_{\text{version 4}} \neq P_{\text{version 5}} \neq P_{\text{mean all versions}}$

test statistic: $X^2_c$

critical region $= \left\{ X^2 > 9.49 \right\}$ with $\alpha = 0.05$ and 4 degrees of freedom

The null hypothesis was rejected only for the percentage of respondents who think we should spend more money on development aid ($\chi^2 = 15.037$). All other percentages can be considered equal on a 5% significance level. Therefore, we can safely conclude that question 1 does not entail question-order effects.
### Table 5.9: Possible order effects in question 1

<table>
<thead>
<tr>
<th>Version number</th>
<th>More money</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fighting unemployment</td>
<td>47.4</td>
<td>30.8</td>
<td>34.9</td>
<td>41.4</td>
<td>41.0</td>
</tr>
<tr>
<td>Development aid</td>
<td>23.1*</td>
<td>5.1*</td>
<td>24.1*</td>
<td>12.6*</td>
<td>9.6*</td>
</tr>
<tr>
<td>The issue of immigration</td>
<td>20.5</td>
<td>6.4</td>
<td>16.9</td>
<td>18.4</td>
<td>18.9</td>
</tr>
<tr>
<td>Fighting congestion</td>
<td>23.1</td>
<td>30.8</td>
<td>24.1</td>
<td>23.0</td>
<td>25.3</td>
</tr>
<tr>
<td>Fighting crime</td>
<td>43.6</td>
<td>51.3</td>
<td>45.8</td>
<td>50.6</td>
<td>48.2</td>
</tr>
<tr>
<td>Fighting the housing shortage</td>
<td>44.9</td>
<td>35.9</td>
<td>34.9</td>
<td>35.6</td>
<td>32.5</td>
</tr>
<tr>
<td>Protecting the environment</td>
<td>66.7</td>
<td>52.6</td>
<td>55.4</td>
<td>52.9</td>
<td>47.0</td>
</tr>
<tr>
<td>Improving education</td>
<td>59.0</td>
<td>50.0</td>
<td>51.8</td>
<td>48.3</td>
<td>57.8</td>
</tr>
</tbody>
</table>

| Version number | Same amount of money | | | | |
|----------------|---------------------|-----------------|-----------------|-----------------|
| Fighting unemployment | 46.2 | 59.0 | 53.0 | 51.7 | 51.8 |
| Development aid | 41.0 | 46.2 | 43.4 | 44.8 | 45.8 |
| The issue of immigration | 30.8 | 37.2 | 39.8 | 42.5 | 32.5 |
| Fighting congestion | 21.8 | 25.6 | 30.1 | 33.3 | 21.7 |
| Fighting crime | 46.2 | 44.9 | 41.0 | 39.1 | 48.2 |
| Fighting the housing shortage | 43.6 | 48.7 | 53.0 | 52.9 | 53.0 |
| Protecting the environment | 30.8 | 41.0 | 38.6 | 41.4 | 47.0 |
| Improving education | 34.6 | 47.4 | 41.0 | 47.1 | 37.3 |

<table>
<thead>
<tr>
<th>Version number</th>
<th>Less money</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fighting unemployment</td>
<td>3.8</td>
<td>7.7</td>
<td>7.2</td>
<td>3.4</td>
<td>3.6</td>
</tr>
<tr>
<td>Development aid</td>
<td>32.1</td>
<td>44.9</td>
<td>27.7</td>
<td>35.6</td>
<td>3.6</td>
</tr>
<tr>
<td>The issue of immigration</td>
<td>21.8</td>
<td>35.9</td>
<td>25.3</td>
<td>27.6</td>
<td>30.1</td>
</tr>
<tr>
<td>Fighting congestion</td>
<td>50.0</td>
<td>42.3</td>
<td>43.4</td>
<td>40.2</td>
<td>48.2</td>
</tr>
<tr>
<td>Fighting crime</td>
<td>6.4</td>
<td>2.6</td>
<td>9.6</td>
<td>6.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Fighting the housing shortage</td>
<td>10.3</td>
<td>10.3</td>
<td>7.2</td>
<td>8.0</td>
<td>14.5</td>
</tr>
<tr>
<td>Protecting the environment</td>
<td>2.6</td>
<td>2.6</td>
<td>3.6</td>
<td>4.6</td>
<td>6.0</td>
</tr>
<tr>
<td>Improving education</td>
<td>3.8</td>
<td>1.3</td>
<td>2.4</td>
<td>1.1</td>
<td>2.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Version number</th>
<th>Don't know</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fighting unemployment</td>
<td>2.6</td>
<td>2.6</td>
<td>4.8</td>
<td>3.4</td>
<td>3.6</td>
</tr>
<tr>
<td>Development aid</td>
<td>3.8</td>
<td>3.8</td>
<td>4.8</td>
<td>6.9</td>
<td>6.0</td>
</tr>
<tr>
<td>The issue of immigration</td>
<td>26.9</td>
<td>20.5</td>
<td>18.1</td>
<td>11.5</td>
<td>20.5</td>
</tr>
<tr>
<td>Fighting congestion</td>
<td>5.1</td>
<td>1.3</td>
<td>2.4</td>
<td>3.4</td>
<td>4.8</td>
</tr>
<tr>
<td>Fighting crime</td>
<td>3.8</td>
<td>1.3</td>
<td>3.6</td>
<td>3.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Fighting the housing shortage</td>
<td>1.3</td>
<td>5.1</td>
<td>4.8</td>
<td>3.4</td>
<td>-</td>
</tr>
<tr>
<td>Protecting the environment</td>
<td>-</td>
<td>3.8</td>
<td>2.4</td>
<td>1.1</td>
<td>-</td>
</tr>
<tr>
<td>Improving education</td>
<td>2.6</td>
<td>1.3</td>
<td>4.8</td>
<td>3.4</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Number of respondents(1) | 78 | 78 | 83 | 87 | 83 |

* Percentages differ on a 5% significance level.

(1) Total number of respondents is 409 (410 minus one non-responses).

Order effects are tested again in question 4. Question 4 (presented below) inquires after the various roles IJburg plays. As in question 1, the answer possibilities rotate over the 5 versions.
The last answer category is an open question and respondents could fill in any role they thought IJburg will play. Mostly, the following answers were given in this open answer category: "IJburg is just a (political) prestige project", "IJburg is a waste of money", or "IJburg is essential to the vitality of Amsterdam".

Table 5.10 presents the percentages of respondents who stated that IJburg plays a particular key role. For instance, the first percentage indicates the percentage of respondents who received version 1 and stated that IJburg is a project leading mainly to improving the housing situation (29.5%). The same $\chi^2$-test as used above is used to test the null hypothesis that the percentages for a certain category (like 'combating congestion') are the same over the five versions. It turns out that none of the percentages differ on a 5% significance level. Evidently, order effects also do not exist in question 4.

**Table 5.10: Possible order effects in question 4**

<table>
<thead>
<tr>
<th>Version number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>improving the housing situation</td>
<td>29.5</td>
<td>16.9</td>
<td>31.7</td>
<td>38.6</td>
<td>29.3</td>
</tr>
<tr>
<td>combating congestion</td>
<td>1.3</td>
<td>2.6</td>
<td>8.5</td>
<td>3.4</td>
<td>2.4</td>
</tr>
<tr>
<td>partial destruction of a green area</td>
<td>32.1</td>
<td>40.3</td>
<td>24.4</td>
<td>30.7</td>
<td>26.8</td>
</tr>
<tr>
<td>total devastation of a green area</td>
<td>20.5</td>
<td>18.2</td>
<td>17.1</td>
<td>11.4</td>
<td>20.7</td>
</tr>
<tr>
<td>employment creation</td>
<td>1.3</td>
<td>5.2</td>
<td>2.4</td>
<td>1.1</td>
<td>2.4</td>
</tr>
<tr>
<td>decreasing possibilities for recreation</td>
<td>3.8</td>
<td>9.1</td>
<td>4.9</td>
<td>3.4</td>
<td>2.4</td>
</tr>
<tr>
<td>a different role</td>
<td>11.5</td>
<td>7.8</td>
<td>11.0</td>
<td>11.4</td>
<td>15.9</td>
</tr>
<tr>
<td><strong>Number of respondents(1)</strong></td>
<td>78</td>
<td>77</td>
<td>82</td>
<td>88</td>
<td>82</td>
</tr>
</tbody>
</table>

(1) Total number of respondents is 407 (410 minus three non-responses).
5.9 Results of the Contingent Valuation Question

In the contingent valuation question respondents are asked to state their willingness to pay for the IJmeer Fund. For the exact wording of the question, the reader is referred to section 5.4.1. Respondents are offered a certain bid $fx$, which they can either accept or reject ($x \in \{2.50, 5, 10, 15, 25\}$). Also a “don’t know” category exists. If a respondent rejects the offer, he or she is given the opportunity to fill out another bid which is either lower or higher than the first bid of $fx$. Figure 5.1 reflects this routing mechanism.

![Figure 5.1: Routing of the contingent valuation question](image)

Out of the total of 191 CVM respondents, 185 respondents answered the contingent valuation question. Table 5.11 below gives the distribution of the answers. For instance, 27% of the respondents are willing to pay the offered bid of $fx$, 8% are willing to pay more than $fx$, and 53% are willing to pay less than $fx$, while 12% are not sure what they are willing to contribute. The table also gives the motivation in those cases, where the respondent is willing to pay less or is not sure what to pay. For example, out of the 22 respondents who are not sure how much they are willing to contribute to the Fund, 23% say they are not sure because they do not have sufficient information to decide how much the compensation of recreational and natural losses is worth to them.
Table 5.11: Response question 7, 8 and 9 (in %; (..) absolute numbers)

<table>
<thead>
<tr>
<th>Question 7 (n=185)*</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>About fx</td>
<td>27% (50)</td>
</tr>
<tr>
<td>More than fx</td>
<td>8% (15)</td>
</tr>
<tr>
<td>Less than fx</td>
<td>53% (98)</td>
</tr>
<tr>
<td>Don't know</td>
<td>12% (22)</td>
</tr>
</tbody>
</table>

* 6 non-responses, total CVM sample equals 191.

<table>
<thead>
<tr>
<th>Question 8 (n=98)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I cannot afford it</td>
</tr>
<tr>
<td>It is not worth that much to me</td>
</tr>
<tr>
<td>Others should pay for it</td>
</tr>
<tr>
<td>Government should pay for it</td>
</tr>
<tr>
<td>Local authorities should pay for it</td>
</tr>
<tr>
<td>Property developer should pay for it</td>
</tr>
<tr>
<td>(Future) residents of Uburg should pay for it</td>
</tr>
<tr>
<td>I am against Uburg</td>
</tr>
<tr>
<td>I am against a Fund/payment</td>
</tr>
<tr>
<td>I contribute to environmental organizations</td>
</tr>
<tr>
<td>Different reasons</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 9 (n=22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am not sure how much it is worth to me</td>
</tr>
<tr>
<td>The decision is not mine to make</td>
</tr>
<tr>
<td>Insufficient information</td>
</tr>
<tr>
<td>I am not sure if my household can afford it</td>
</tr>
<tr>
<td>Government should pay for it</td>
</tr>
<tr>
<td>Local authorities should pay for it</td>
</tr>
<tr>
<td>Property developer should pay for it</td>
</tr>
<tr>
<td>(Future) residents of Uburg should pay for it</td>
</tr>
<tr>
<td>I am against Uburg</td>
</tr>
<tr>
<td>I am against a Fund/payment</td>
</tr>
<tr>
<td>I contribute to environmental organizations</td>
</tr>
<tr>
<td>Different reasons</td>
</tr>
</tbody>
</table>

Since a “don’t know” category is rarely added to a contingent valuation question, there is no univocal view on how these answers should be treated in a statistical analysis. One practice is to drop the “don’t know” responses from the data set (McClelland and Whittington, in Wang, 1997). The adverse consequences of this procedure are a reduction of the sample size and loss of information. Carson et al. (1996) suggest treating the “don’t knows” as “no” responses (i.e., equal to $f_0$). This is a conservative strategy. In this study, a mixture of these two procedures is used. The “don’t knows” are treated as “no” votes if the motivation given for their response in question 9 is one of the following reasons:

- I am not sure how much it is worth to me
- The decision is not mine to make
- Insufficient information
- I am not sure whether my household can afford such a sum
- I already contribute to environmental organizations
• Different reasons

In all other cases the “don't knows” are dropped from the data set as they are assumed to convey protest bids. This will be explained in the next section.

5.9.1 Mean and Total Willingness to Pay

The aim of the contingent valuation question is to be able to estimate the mean willingness to pay (WTP). In order to calculate a correct value, the so-called protest bids and outliers will have to be omitted. Outliers refer to WTP values that represent an implausibly large part of the respondent's income, for example more than 10%. In this study outliers are not present. Protest bids are typically zero amounts or “don't knows” because the respondent thinks that others should pay or opposes to the idea of contribution. In this sample two groups of protest voters exist.

The first group of protest voters are those respondents who state they are willing to pay $0 (question 7) and motivate their bid by one of the following reasons (question 8):

• Others should pay for it
• Government should pay for it
• Local authorities should pay for it
• Property developer should pay for it
• (Future) residents of IJburg should pay for it
• I am against IJburg
• I am against a Fund/payment

The second group of protest voters are those respondents who state they are not sure how much they are willing to pay (question 7) and motivate their bid by one of the following reasons (question 9):

• Government should pay for it
• Local authorities should pay for it
• Property developer should pay for it
• (Future) residents of IJburg should pay for it
• I am against IJburg
• I am against a Fund/payment
The first group of protest voters consists of 61 respondents and the second group of 5 respondents, which adds up to 66 protest voters in the CVM subsample. After excluding the two groups of protest voters from the sample, 119 CVM respondents remain. The mean WTP is $8.62. If the protest voters would not be excluded, the mean WTP would of course be lower, since protest votes are typically zero amounts. When treating the “don’t knows” as “no” responses (i.e., equal to $0), the mean WTP would be $5.79 (n=185).

The total WTP is calculated by multiplying the mean of $8.62 by the number of households in the population (390,000), which amounts to $3,361,800. According to the project planners of IJburg, the costs of mitigating activities with respect to nature conservation and recreation amount to $36 million and $65 million, respectively. So, the WTP of the residents of Amsterdam is much too low to bear the costs of the mitigating activities. On the other hand, the result from the CVM study could also be compared with the $15 million paid into the ‘Natuurontwikkelingsfonds IJburg’. Still, the $3.4 million is meagre compared to $15 million. However, it is important to note that the compensation of natural and recreation values benefits not just the Amsterdam residents, but residents in a wide area around the IJmeer. It is even thinkable that the entire Dutch population benefits from the restoration of natural and recreation values in the IJmeer. In that case, the CVM result (i.e. $8.62) should be multiplied by a much larger number of households and, consequently, the total sum of the contributions would be much larger.

Although some people will not “use” the recreation or green areas around IJburg now or in the future, they may still value the existence of these areas. This is called existence value or non-use value. Since questions 23 and 24 in the questionnaire have made clear, which respondents are currently using IJburg and which are not and do not anticipate to do so in the future, it is possible to divide the mean WTP into a use value and a non-use value. Note that this procedure is more easily applicable when using CVM, as this is a direct method (cf. chapter 3, section 3.3). The mean WTP for respondents who are currently using the IJmeer, is $10.06 (n=73), and the mean WTP for respondents who do not currently use the IJmeer and do not plan to do so in the future, is $7.21 (n=42). The value that can be attributed purely to the use of the IJmeer (or IJburg) is $10.06 minus $7.21, thus $2.85. Apparently, using the IJmeer (or IJburg) for living or for recreational purposes is less important than the mere existence of the IJmeer.
5.9.2 Determinants of the Willingness to Pay

It is interesting to investigate the determinants of the stated WTP amounts. A bid curve can be estimated by using the WTP amounts as a dependent variable and a range of independent variables. In this study it was found that the WTP depends on the following variables:12

- net monthly household income (y)
- age (a)
- level of education (e)
- sex (s)
- family size (fs)
- presence of children in the household (ch)
- membership of an environmental organization (mem)
- environmental political preference (pref)
- disbelief in the possibility of compensation (pos)
- conviction that compensation is desirable (des)

The last three of these variables will be explained below. The others speak for themselves.

The variable ‘environmental political preference’ follows from the responses to question 1. This question is reviewed in section 5.8. In short, the question asks respondents to state whether we should spend more, less, or exactly as much as we are currently spending on the various policy issues in the Netherlands, among which ‘protecting the environment’. A dummy variable is created with a value of 1 if the respondent marks the “we should spend more” option, and with a value of 0 for all other options.

The variable ‘disbelief in the possibility of compensation’ is based on the answers to question 5 (cf. section 5.7). A dummy variable is created with a value of 1 if the respondent does not believe that it is possible to compensate for the nature and recreation values that are lost because of the construction of IJburg.

The variable ‘conviction that compensation is desirable’ is based on the answers to question 6 (cf. section 5.7). A dummy variable is created with a value of 0 if the respondent thinks that it is desirable to compensate for the nature and recreation values that are lost because of the construction of IJburg, and a value of 1 otherwise.
The results of the regression are given in table 5.12.

**Table 5.12: Determinants of the WTP**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard deviation</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-10.687</td>
<td>5.740</td>
<td>-1.862 *</td>
</tr>
<tr>
<td>Net monthly household income</td>
<td>0.001</td>
<td>0.0004</td>
<td>2.061</td>
</tr>
<tr>
<td>Age</td>
<td>0.161</td>
<td>0.068</td>
<td>2.351</td>
</tr>
<tr>
<td>Level of education</td>
<td>6.510</td>
<td>2.793</td>
<td>2.331</td>
</tr>
<tr>
<td>Sex</td>
<td>-1.755</td>
<td>2.293</td>
<td>-0.765 *</td>
</tr>
<tr>
<td>Family size</td>
<td>-3.343</td>
<td>1.592</td>
<td>-2.099</td>
</tr>
<tr>
<td>Presence of children in the household</td>
<td>14.296</td>
<td>4.719</td>
<td>3.029</td>
</tr>
<tr>
<td>Membership of an environmental organization</td>
<td>2.557</td>
<td>2.259</td>
<td>1.132 *</td>
</tr>
<tr>
<td>Environmental political preference</td>
<td>8.805</td>
<td>3.786</td>
<td>2.325</td>
</tr>
<tr>
<td>Disbelief in the possibility of compensation</td>
<td>-4.470</td>
<td>2.231</td>
<td>-2.004</td>
</tr>
<tr>
<td>Conviction that compensation is desirable</td>
<td>3.605</td>
<td>2.497</td>
<td>1.444 *</td>
</tr>
</tbody>
</table>

N=117 ** R²=0.2517

* not statistically significant at a 5% level.

** based on a sample size of 191 minus 6 non-responses and minus 66 protest voters.

The results show that the WTP is higher when the respondent’s net monthly household income is higher. The same applies to the variable ‘age’. The variable ‘level of education’ is a dummy variable with a value of 1 if the respondent has a higher level of education (Havo/VWO/HBO or university). The results indicate that the level of education is significantly and positively related to the WTP: the higher the respondent’s education, the higher his or her WTP. The variable ‘sex’ is a dummy variable with a value of 1 if the respondent is female and a value of 0 if the respondent is male. Sex does not have a significant influence on the WTP. This variable is nevertheless included, to prevent an omitted-variable effect. ‘Family size’ and the ‘presence of children in the household’ have a significant influence on the WTP. The larger the household, the lower the WTP, whereas the WTP is higher if children are present.

Two variables that measure the environmental concern of respondents are included in the model. The first is ‘membership of an environmental organization’. Respondents who are a member of one or more environmental organizations state a higher WTP. However, this relation is not significant. The second variable that measures environmental concern is the variable ‘environmental political preference’. This variable is significant and has a positive effect on the WTP: respondents who state they would like the government to spend more money on environmental protection, state a higher WTP.
Finally, two variables are included that measure the attitudes towards the possibility and the desirability of compensation for lost nature and recreation values. Respondents who do not believe that the lost nature and recreation values can be compensated for, state a lower WTP. Respondents who think that compensation is desirable, state a higher WTP. However, this latter relation with the WTP is not significant.

5.9.3 Starting-point Bias

When answering the contingent valuation question, respondents consider the proposed contribution to the IJmeer Fund. This proposed amount can be either accepted or rejected (and then possibly adjusted) by the respondent. It is conceivable that the size of the amount suggested in the questionnaire serves as a starting-point for the respondent to base his or her final contribution upon. Even if a respondent rejects the initial bid, starting-points well above the respondent’s true WTP will tend to increase the stated WTP, while starting-points well below the true WTP, will tend to decrease the stated WTP. If this is indeed the case, one speaks of a starting-point bias and the contingent valuation question then no longer conveys the true WTP.

This study contains five versions each with a different starting-point: $f2.50, f5, f10, f15$ and $f25$. The hypothesis that the mean WTP ($\mu$) is the same over the five versions is now tested. This can be done in various ways. One possibility is by a simple t-test of the mean WTP per version ($\mu_{version}$) versus the sample mean WTP ($\mu_{mean all versions}$) of $f8.62$. The disadvantage of this test is that the mean WTP in version 3 ($\mu_{version 3}$) will not differ significantly from the sample mean $f8.62$, since the sample sizes per version are distributed rather equally. Table 5.13 gives the results of the tests.

<table>
<thead>
<tr>
<th>Version</th>
<th>Mean WTP</th>
<th>Standard deviation</th>
<th>Starting-point</th>
<th>Sample size</th>
<th>t-value for $\mu_{version x} = f8.62$ with $x = 1,\ldots,5$**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.21</td>
<td>7.3144</td>
<td>2.50</td>
<td>37</td>
<td>-4.50</td>
</tr>
<tr>
<td>2</td>
<td>4.11</td>
<td>5.1893</td>
<td>5</td>
<td>35</td>
<td>-5.14</td>
</tr>
<tr>
<td>3</td>
<td>8.97</td>
<td>12.9601</td>
<td>10</td>
<td>39</td>
<td>0.17</td>
</tr>
<tr>
<td>4</td>
<td>11.50</td>
<td>14.4950</td>
<td>15</td>
<td>40</td>
<td>1.26</td>
</tr>
<tr>
<td>5</td>
<td>16.35</td>
<td>13.6169</td>
<td>25</td>
<td>34</td>
<td>3.31</td>
</tr>
<tr>
<td>All versions</td>
<td>8.62</td>
<td></td>
<td>-</td>
<td>185*</td>
<td></td>
</tr>
</tbody>
</table>

* CVM sample of 191 minus 6 non-responses.
** With $n$ is 40, the critical region is $\{t \leq 2.021 \lor t \geq 2.021\}$. 

Table 5.13: Tests for starting-point bias
As expected, $\mu_{version 3}$ does not differ significantly from the sample mean $f8.62$. Also, $\mu_{version 4}$ does not significantly differ from $f8.62$. However, the mean WTP in version 1, 2 and 5 is significantly different from the sample mean.

Another possibility for testing for starting-point bias, is by a regression with the WTP as the dependent variable and starting point as the independent variable. If the coefficient of the starting-point ($sp$) significantly differs from 0, a starting-point bias prevails.

$$WTP = \alpha + \beta(sp) + \epsilon = -0.722 + 3.120(sp)$$

$$s_{\alpha} = \text{standard deviation of } \alpha = 2.501$$

$$s_{\beta} = \text{standard deviation of } \beta = 0.764$$

The regression indicates that the WTP is significantly related to the version number, since the $t$-value for $H_0: \beta = 0$ is 4.084, which lies in the critical region.

Based on these two tests, it is concluded that a strong starting-point bias is present in this study.

### 5.10 Results of the Conjoint Measurement Question

The conjoint measurement version of the questionnaire contains a set of six vignettes. Each of these six vignettes describes a particular situation regarding the green and recreation areas in and around IJburg. The situation is described in terms of changes in nature and recreation and a monetary contribution to the IJmeer Fund (cf. section 5.4.2 of this chapter). The respondent is asked to fulfil a threefold task regarding the vignettes:

1. The respondent is asked to rank the six vignettes from most to least preferred.
2. The respondent is asked to give a report mark (ranging from 0 to 10) to each of the six vignettes.
3. The respondent is asked to indicate which of the six vignettes are acceptable, i.e., would he or she indeed be willing to pay the contribution asked for in the vignettes.

In the analysis below, the information based on all of these three questions will be used. The answers of the respondents (the rank order, the report marks as well as
the acceptability) provide an insight into the importance of the three attributes and allow us to deduce price compensations for changes in the level of the two other attributes, nature and recreation. Section 5.10.1 discusses the results from the analysis based on the rank orderings given by the respondents. The analysis based on report marks is given in section 5.10.2, and section 5.10.3 deals with the results based on the acceptability question. Subsequently, these three analyses are compared in section 5.10.4. Finally, in section 5.10.5 the report marks are related to several personal characteristics.

5.10.1 The Analysis based on Rank Orderings

Before turning to the actual results, the theoretical model underlying the rank-ordered analysis will be examined (cf. chapter 4, section 4.2.1). The importance of the three attributes can be deduced from the rank order given by the respondents. Such a rank-ordered analysis is based on the random utility theory. Usually, a rank-ordered logit model is applied to specify the utility function \( U \) (Beggs et al., 1981). The utility function of person \( i \) for vignette \( j \) consists of a deterministic part \( V_j \) and a stochastic, i.e. unpredictable, part \( \varepsilon_i \). The various attributes \( N \) (nature), \( R \) (recreation) and \( P \) (price) are included in \( V_j \).

\[
U_{ij} = V_{ij} + \varepsilon_{ij} = \beta_{i1}N_j + \beta_{i2}R_j + \beta_{i3}P_j + \varepsilon_{ij}
\]

Respondent \( i \) might, for instance, prefer vignette 1 to vignette 2, and vignette 2 to 3 and so on until vignette 6. This particular rank order can be presented as follows (dropping the individual index \( i \) for the sake of simplicity):

\[
U_1 > U_2 > U_3 > U_4 > U_5 > U_6
\]

In more general terms, the probability of a rank order for individual \( i \), \( R_i = (r_1, r_2, r_3, r_4, r_5, r_6) \), can be represented as follows:

\[
\text{Prob}[R_i] = \prod_{j=1}^{6} \frac{\exp(\beta_{1j}N_j + \beta_{2j}R_j + \beta_{3j}P_j)}{\sum_{k \neq j}^{6} \exp(\beta_{1k}N_k + \beta_{2k}R_k + \beta_{3k}P_k)}
\]

The parameters \( \beta_a \) (\( a = 1,2,3 \)) can be estimated by using the maximum likelihood
procedure. Table 5.14 gives the results of the rank orderings in the IJburg experiment.

### Table 5.14: Rank-ordered logit results based on rankings (n=216)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter estimate</th>
<th>Standard deviation</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature</td>
<td>0.0777</td>
<td>0.00291</td>
<td>26.70</td>
</tr>
<tr>
<td>Recreation</td>
<td>0.0192</td>
<td>0.00365</td>
<td>5.26</td>
</tr>
<tr>
<td>Price</td>
<td>-0.0483</td>
<td>0.00650</td>
<td>-7.43</td>
</tr>
</tbody>
</table>

* Sample size of 219 minus three non-responses.

All three attributes are significant factors for predicting the rank of the vignette. Nature and recreation have a positive sign and price has a negative sign, as was to be expected. Nature has the strongest effect, recreation the weakest.

The ultimate aim of the vignettes analysis (i.e. rank-ordered analysis) to come up with the prices of the attributes. For instance, how much could the price be increased if the attribute nature is increased by 10% and the attribute recreation by 5%? In short, the relationship between price on the one hand and nature and recreation on the other hand needs to be established.

Departing from the above mentioned results based on the rank orderings given by the respondents, the price compensation is determined as follows:

\[
0.0777(N_j^{old}) + 0.0192(R_j^{old}) - 0.0483(P_j^{old}) = \\
0.0777(N_j^{new}) + 0.0192(R_j^{new}) - 0.0483(P_j^{new}) \
\Rightarrow \\
0.0777(\Delta N_j) + 0.0192(\Delta R_j) - 0.0483(\Delta P_j) = 0 \
\Rightarrow \\
\Delta P_j = 1.6087(\Delta N_j) + 0.3975(\Delta R_j)
\]

If \(N\) is increased by 10% and \(R\) is increased by 5%, the price increases by $18.07. Or, in terms of the survey, the contribution to the IJmeer Fund would increase by $18.07.
5.10.2 The Analysis based on Report Marks

It is also possible to model the probability that a vignette receives a particular report mark. The model used to predict these chances is an ordered logit model.

\[ \text{logit}(\text{prob}\{\text{report mark } \leq z\}) = \alpha_{z+1} + \beta_1 N + \beta_2 R + \beta_3 P \]

As in the rank orderings analysis, here also all three attributes are significant factors for the prediction of the report mark of the vignette. And again, all attributes have the expected sign. The probability that a vignette receives a high report mark is positively related to the level of the nature and recreation attribute, and negatively related to the price attribute. The effect of the attribute nature is the strongest, whereas the effect of the attribute recreation is the weakest, just as before.

To elucidate these results, let us take a random vignette X and calculate its probabilities for a certain rank.

### Table 5.15: Ordered logit results based on report marks \((n=194)\) *

<table>
<thead>
<tr>
<th>Variable**</th>
<th>Parameter estimate</th>
<th>Standard deviation</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\alpha_1)</td>
<td>-3.3028</td>
<td>0.1381</td>
<td>-23.92</td>
</tr>
<tr>
<td>(\alpha_2)</td>
<td>-2.7298</td>
<td>0.1256</td>
<td>-21.73</td>
</tr>
<tr>
<td>(\alpha_3)</td>
<td>-2.1307</td>
<td>0.1151</td>
<td>-18.51</td>
</tr>
<tr>
<td>(\alpha_4)</td>
<td>-1.5073</td>
<td>0.1067</td>
<td>-14.13</td>
</tr>
<tr>
<td>(\alpha_5)</td>
<td>-0.8796</td>
<td>0.1009</td>
<td>-8.72</td>
</tr>
<tr>
<td>(\alpha_6)</td>
<td>-0.0937</td>
<td>0.0977</td>
<td>-0.96#</td>
</tr>
<tr>
<td>(\alpha_7)</td>
<td>-0.5177</td>
<td>0.0986</td>
<td>5.25</td>
</tr>
<tr>
<td>(\alpha_8)</td>
<td>-1.2248</td>
<td>0.1039</td>
<td>11.79</td>
</tr>
<tr>
<td>(\alpha_9)</td>
<td>-1.9242</td>
<td>0.1150</td>
<td>16.73</td>
</tr>
<tr>
<td>(\alpha_{10})</td>
<td>-2.7320</td>
<td>0.1391</td>
<td>19.64</td>
</tr>
<tr>
<td>Nature</td>
<td>0.0544</td>
<td>0.00247</td>
<td>22.02</td>
</tr>
<tr>
<td>Recreation</td>
<td>0.0146</td>
<td>0.00355</td>
<td>4.11</td>
</tr>
<tr>
<td>Price</td>
<td>-0.0308</td>
<td>0.00627</td>
<td>-4.91</td>
</tr>
</tbody>
</table>

* Sample size of 219 minus 15 non-responses and minus 10 inconsistent answers.

** The variables \(\alpha_{z+1}\) are the intercepts belonging to the results for report marks \(z \in \{0, \ldots, 9\}\). For instance, the probability that a particular vignette is given a report mark \(z\), is given by:

\[ \text{logit}(\text{prob}\{\text{report mark } \leq z\}) = \alpha_{z+1} + \beta_1 N + \beta_2 R + \beta_3 P \]

# Not significantly different from zero at a 5% level.
Figure 5.2: An example called vignette X

<table>
<thead>
<tr>
<th>Situation X</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nature:</strong> the quantity of plants and animals in the Umeer increases by 25%</td>
</tr>
<tr>
<td><strong>Recreation:</strong> the possibilities for water sports and other forms of recreation increase by 10%</td>
</tr>
<tr>
<td><strong>one-time contribution:</strong> f10</td>
</tr>
</tbody>
</table>

By way of illustration, the probability that vignette X will be marked 0 out of 10 is calculated (using $\alpha_i$ and the coefficients of the variables nature, recreation and price from table 5.15):

\[
\logit (\text{prob}\{\text{report mark } \leq 0\}) = -3.3028 + 0.0544(25) + 0.0146(10) - 0.0308(10) = -2.1048 \Rightarrow
\]

\[
\text{prob}\{\text{report mark } \leq 0\} = \frac{\exp(-2.1048)}{1 + \exp(-2.1048)} = 0.1086
\]

The probability that vignette X gets the lowest possible mark of 0 out of 10 is ($\leq 0$) is 10.9%. In the same way, the probabilities that the vignette X receives a report mark of 1, 2, ..., until 10 can be calculated. Again these probabilities are cumulative figures. The probability that vignette X is marked 1 out of 10 is calculated by subtracting $\text{prob}\{\text{report mark } \leq 0\}$ from $\text{prob}\{\text{report mark } \leq 1\}$ (e.g., 17.8% minus 10.9% gives 6.9%). The probability that vignette X gets the highest report mark (10 out of 10), is calculated by subtracting $\text{prob}\{\text{report mark } \leq 9\}$ from 1 (e.g., 1 minus 0.9807 gives 0.0193, which implies a 1.9% chance to be rated highest). In other words, the report mark of 10 is the benchmark.

Apart from these probabilities, it is more interesting to investigate the trade-offs between prices on the one hand and nature and recreation on the other. For instance, how much is a 10% increase in the attribute nature and a 5% increase in the attribute recreation worth?

Departing from the results of the analysis based on the report marks, the price equation is determined in such a way that the probability distribution over report marks remains the same. Thus, the probability that a vignette receives a 0 remains the same, the probability that this vignette receives a 1 remains the same, as well as the probabilities for the marks 2 up to and including 10.
With the estimates from table 5.15 the following price equation can be deduced:

\[ \alpha_{z+1} + 0.0544(N_j^{old} + 0.0146(R_j^{old} - 0.0308(P_j^{old}) = \]

\[ 0.0544(\Delta N_j + 0.0146(\Delta R_j) - 0.0308(\Delta P_j = 0 \Rightarrow \]

\[ \Delta P_j = 1.7662(\Delta N_j) + 0.4740(\Delta R_j) \]

If \( N \) is increased by 10\% and \( R \) is increased by 5\%, the price, or the contribution to the IJmeer Fund, increases by \( f22.40 \).

5.10.3 The Analysis based on Acceptability

Finally, it is possible to determine the logit probability that vignette \( X \) is acceptable. Table 5.16 below gives the estimation results of this probability.

**Table 5.16: Logit probability that a vignette is acceptable (\( n=216 \))**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter estimate</th>
<th>Standard deviation</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \alpha )</td>
<td>0.7172</td>
<td>0.1231</td>
<td>5.83</td>
</tr>
<tr>
<td>Nature</td>
<td>0.0512</td>
<td>0.00385</td>
<td>13.13</td>
</tr>
<tr>
<td>Recreation</td>
<td>0.0101</td>
<td>0.00459</td>
<td>2.20</td>
</tr>
<tr>
<td>Price</td>
<td>-0.0349</td>
<td>0.00896</td>
<td>-3.88</td>
</tr>
</tbody>
</table>

* Sample size of 219 minus three non-responses.

Again, all three attributes are significant factors when explaining the acceptability of a vignette. Nature and recreation have the expected positive sign, and price has the expected negative sign. The effect of the attribute nature is the strongest and the effect of the attribute recreation is the weakest effect, and the strength of the effect of the attribute price lies in between.

If we take vignette \( X \) as an example, the acceptability is calculated as follows:

\[
\text{logit}(\text{prob}\{X \text{ is acceptable}\}) = 0.7172 + 0.0512(25) + 0.0101(10) - 0.0349(10) = 1.7492 \Rightarrow \\
\text{prob}\{X \text{ is acceptable}\} = \frac{\exp(1.7492)}{1 + \exp(1.7492)} = 0.8519
\]
So, the probability that vignette X is acceptable is 85.2% and, conversely, the probability that vignette X is not acceptable is 14.8%.

The ultimate aim of the vignettes analysis is to come up with a price tag for the goods under valuation, i.e. the green areas and recreation facilities in the surroundings of IJburg. In sections 5.10.1 and 5.10.2, such price equations were derived based on the results of the analyses of the rank orderings and the report marks, respectively. Here, the price change is calculated based on the acceptability of a vignette. The price equation is derived in the same way as above, using the estimates from table 5.16.

\[
\alpha + 0.0512(N_j^{old}) + 0.0101(R_j^{old}) - 0.0349(P_j^{old}) = \alpha + 0.0512(N_j^{new}) + 0.0101(R_j^{new}) - 0.0349(P_j^{new}) \Rightarrow 0.0512(\Delta N_j) + 0.0101(\Delta R_j) - 0.0349(\Delta P_j) = 0 \Rightarrow \\
\Delta P_j = 1.4670(\Delta N_j) + 0.2894(\Delta R_j)
\]

Increasing N by 10% and R by 5%, now entails a price increase of f16.12.

5.10.4 Comparison of the three Analyses

In the previous three sections, the results from three different vignettes exercises were discussed, namely the rank orderings, the report marks and the acceptability of the vignettes. In this section, these three results will be compared.

Result based on the rank order of the vignettes:
\[
\Delta P_j = 1.6087(\Delta N_j) + 0.3975(\Delta R_j) \\
[1.3840 < \beta_1 < 1.8334] \quad [0.3049 < \beta_2 < 0.4901]
\]

Result based on the report marks of the vignettes:
\[
\Delta P_j = 1.7662(\Delta N_j) + 0.4740(\Delta R_j) \\
[1.3978 < \beta_1 < 2.1346] \quad [0.3237 < \beta_2 < 0.6243]
\]

Result based on acceptability of the vignettes:
\[
\Delta P_j = 1.4670(\Delta N_j) + 0.2894(\Delta R_j) \\
[1.0745 < \beta_1 < 1.8595] \quad [0.1383 < \beta_2 < 0.4405]
\]
Since the same respondents answered the three vignettes questions, it is to be expected that the results will be similar. The 1*-σ-confidence intervals for each parameter \( \beta \) are presented as well (between \( \{\} \)). The standard deviations are assessed by the usual delta-method (e.g., Greene, 1993, p. 297-299).

When comparing the three equations, it is obvious that they are not the same, but that they are similar and that the confidence intervals largely overlap. The price equation based on the acceptability analysis has the lowest coefficients for changes in the attributes nature and recreation. On the other hand, the results based on the report marks analysis give the strongest effects on \( P \) of changes in \( N \) and \( R \). The results based on the rank orderings of vignettes lie somewhere in the middle.

What is the practical relevance of these price equations? Since the exact effect of the construction of IJburg on the quantity of plants and animals in the IJmeer (\( N \)) and on the possibilities for water sports and other forms of recreation (\( R \)) is unknown, it is difficult to compute the corresponding costs or benefits according to the vignettes analysis. Table 5.17 gives an overview of various scenarios.

The pessimistic scenario is based on the lowest possible values in the vignettes, whereas the optimistic scenario is based on the highest possible values in the vignettes (cf. table 5.2 in section 5.4.2 of this chapter). The moderate I scenario is based on the fact that IJburg will cover approximately one sixth of the IJmeer (which is 16.7%). Finally, according to some experts at the Projectbureau of IJburg, the moderate II scenario is a very probable scenario.

**Table 5.17: Costs and benefits of the construction of IJburg (CM)**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Costs/benefits based on rank orderings analysis</th>
<th>Costs/benefits based on report mark analysis</th>
<th>Costs/benefits based on acceptability analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pessimistic: ( \Delta N=-50% ); ( \Delta R=-25% )</td>
<td>( -f90.37 )</td>
<td>( -f100.16 )</td>
<td>( -f80.59 )</td>
</tr>
<tr>
<td>Moderate I: ( \Delta N=-16.7% ); ( \Delta R=-16.7% )</td>
<td>( -f33.50 )</td>
<td>( -f37.41 )</td>
<td>( -f29.33 )</td>
</tr>
<tr>
<td>Moderate II: ( \Delta N=0% ); ( \Delta R=10% )</td>
<td>( f3.98 )</td>
<td>( f4.74 )</td>
<td>( f2.89 )</td>
</tr>
<tr>
<td>Optimistic: ( \Delta N=25% ); ( \Delta R=25% )</td>
<td>( f50.16 )</td>
<td>( f56.01 )</td>
<td>( f43.91 )</td>
</tr>
</tbody>
</table>

The average respondent demands between \( f80.59 \) and \( f100.16 \) as compensation if
the pessimistic scenario is realised (the attribute nature decreases by 50% and recreation by 25%), and between $f29.33$ and $f37.41$ as compensation if the moderate I scenario is realised (both the nature and recreation attributes decrease by 16.7%). On the other hand, the average respondent is willing to contribute between $f43.91$ and $f56.01$ to the IJmeer Fund if the optimistic scenario is realised. Since these three scenarios are all unlikely to be realised, these numbers should be interpreted as limiting values.

It is more plausible to expect only small changes in $N$ and $R$. The reasons for this conjecture are that IJburg is relatively small compared to the IJmeer and that much effort (and money) is put into the restoration of the green and recreation areas. Therefore, the moderate II scenario gives more realistic results. According to this scenario, respondents are willing to contribute between $f2.89$ and $f4.74$ if the attribute recreation increases by 10% and the attribute nature remains the same (that is: the consequences of the construction of IJburg for the natural environment are fully compensated).

5.10.5 Relating Report Marks to Personal Characteristics

When discussing the CVM results in section 5.9.2, the WTP was explained in terms of several variables, like income, age and environmental preference. When using conjoint measurement, it is also possible to take these personal characteristics of the respondents into consideration. For instance, we could relate the report marks as stated by respondents to personal characteristics. The choice for report marks instead of rank orderings or acceptability is motivated by the fact that the informational efficiency of ratings is higher than that of rankings (e.g., rank orderings and acceptability), since ratings express preference intensities as well as a preference order (cf. chapter 4, section 4.2).

Report marks can be viewed as an indicator of, say, satisfaction with the offered vignette, given the personal circumstances of the respondent. Since report marks are measured on a limited, discrete scale from 0 to 10, it is not possible to run an OLS regression on this variable without objections. Therefore, the report marks are transformed to a $[-x, +x]$ scale according to a method described in Plug and Van Praag (1995). This method replaces the report mark $RM$ from 0 to 10 by numbers $RM^*$, defined as:

$$RM^*(RM) = N^{-1} \left( \sum_{j=1}^{RM-1} p_j + \frac{1}{2} p_{RM} : 0.1 \right)$$
where \( N \) stands for the standard normal distribution, and \( p_{RM} \) is the sample fraction of individuals who gave report mark \( RM \) (\( = 0, \ldots, 10 \)). This transformation is called the empirical-normal transformation.

Apart from the three attributes nature (\( N \)), recreation (\( R \)) and price (\( P \)), it was found that the report mark stated by an individual, is determined by the following variables:\(^{15}\)

- net monthly household income (\( \ln[y] \))
- age (\( a \) and \( a^2 \))
- level of education (\( e \))
- sex (\( s \))
- family size (\( fs \))
- presence of children in the household (\( ch \))
- environment-friendliness (\( env \))
- intention to move out of Amsterdam (\( move \))
- no desire to live in IJburg (\( live \))

The last three of these variables will be explained below; the others speak for themselves.

The variable ‘environment-friendliness’ follows from the responses to question 21 (cf. appendix I at the end of this book). The question runs as follows: “Do you consider yourself or your household to be environment-friendly?”. The possible answers were “yes”, “some” or “no”. A dummy variable is created with a value of 1 if the respondent marks the “yes” option, and a value of 0 otherwise.

The variable ‘intention to move out of Amsterdam’ is based on the answers to question 16 (cf. appendix I): “Do you have any plans to move to a location outside Amsterdam?”. The respondent could fill in “yes” or “no”. A dummy variable is created with a value of 1 if the respondent does intend to move out of Amsterdam, and a value of 0 otherwise.

The variable ‘no desire to live in IJburg’ is based on the answers to question 17 (cf. appendix I): “Would you like to live in IJburg?”. The respondents could answer “yes”, “no” or “don’t know”. A dummy variable is created with a value of 1 if the respondent does not want to live on IJburg, and a value of 0 otherwise.

The results of the OLS regression are presented in table 5.18.
The three attributes in the vignettes are significant and have the expected signs: nature and recreation have a positive impact on the report marks, whereas price has a negative impact.

Furthermore, the results show that respondents with higher net monthly household incomes state lower report marks. Older people state higher report marks, although this effect is not significant. The variable ‘level of education’ is a dummy variable with a value of 1 if the respondent has a higher level of education (Havo/VWO/HBO or university). The results indicate that the level of education is negatively related to the report marks: the higher someone’s education, the lower the report mark for a certain vignette. Apparently, higher educated people are more critical towards and less satisfied with the offered vignettes. However, this relation is not significant.

The variable ‘sex’ is a dummy variable with a value of 1 if the respondent is female and a value of 0 if the respondent is male. Sex does not have a significant influence on the stated report marks. This variable is nevertheless included to prevent an omitted-variable effect. The variables ‘family size’ and the ‘presence of children in the household’ both have a significant influence. The larger the household, the lower the report mark stated, whereas the report mark is higher if children are present.

Respondents who view themselves or their households as environment-friendly, state higher report marks. People who have plans to move out of Amsterdam give lower report marks. Finally, the variable ‘no desire to live in IJburg’ is significant and
has a positive effect on the stated report mark: respondents who do not want to live in IJburg, give a lower report mark to a certain vignette.

5.11 Comparison of the CM and the CVM Results

In section 5.11.1 the results from the CM sample and those from the CVM sample are compared. In 5.11.2, the hypothesis stated at the outset of this research (in section 5.2), namely that respondents find it easier and more acceptable to give an order of alternatives (a relative valuation, as in CM) than to state an absolute number (as in the CVM), will be considered in more detail. Since every CM respondent also received a so-called contingent valuation vignette, it is possible to estimate and compare a mean WTP of CM respondents which is based on the same information that the CVM respondents based their WTP response upon. This comparison will be presented in section 5.11.3.

5.11.1 Comparison of CM and CVM Valuation Results

The mean WTP of the CVM respondents is $8.62. The CM results cannot be presented in such a simple one-dimensional figure, because CM does not just result in a mean WTP but in price equations with the attributes from the vignettes as inputs.

$$\Delta P_j = \beta_1(\Delta N_j) + \beta_2(\Delta R_j)$$

The eventual price or compensation depends upon the changes in the levels of the attributes (different $\Delta N_j$ and $\Delta R_j$) and the analysis chosen ($\beta_1$ and $\beta_2$ are unequal but similar for the analyses based on rank orderings, report marks and acceptability of vignettes). Since the consequences of the construction of IJburg for nature and recreation are not known in advance, these changes in the levels of the attributes ($\Delta N_j$ and $\Delta R_j$) are not known and, thus, neither is the eventual price or compensation ($\Delta P_j$).

Because IJburg is relatively small compared to the IJmeer, and because much effort (and money) is put into the restoration of the green and recreation areas, the ultimate consequences of the construction of IJburg for nature and recreation will probably be rather small, as was mentioned earlier. For instance, if the variables nature and recreation both increase by 3.85%, and if we depart from the price equation based on the analysis of the report marks, the corresponding mean WTP would be $8.62,
which matches the CVM result.

In conclusion, a straight-forward comparison between the CVM result and CM result is impossible in this case, since the CM result cannot be predicted for IJburg. In short, this incomparability is due to the fact that the CVM result is merely a one-dimensional figure measuring one potential change, whereas the CM result is a multidimensional equation measuring various potential changes. In this case of IJburg, the two form an interesting couple: the CVM measures the total value, whereas CM provides an insight into the importance of the attributes.

5.11.2 Comparison of CM and CVM Response Behaviour

In this section, the hypothesis is examined that respondents find it easier and more acceptable to answer indirect valuation questions, like the ranking of vignettes, than to answer such questions directly, in the form of an absolute WTP. From section 5.5 (tables 5.3 and 5.4) we already know that the response rates and the item non-response with regard to the valuation questions tend to support this hypothesis.

For a further examination of the hypothesis, the protest behaviour of the respondents is studied. In the CVM study, 66 protest votes (34.6%) were found, that is, bids which are typically zero amounts or "don't knows" because the respondent thinks that others should pay or is opposed to the idea of contribution. Since in the conjoint measurement context no definition of protest voters exists yet, it is difficult to compare the results of the CVM and CM on this matter. However, by describing the CM protest voters in our own way, a careful comparison between the two methods is possible. Here, the following three approaches are suggested.

Protest voters in the CM subsample may be defined as:

1. Respondents who are not willing to accept any of the six vignettes offered (including the vignette they themselves ranked highest);
2. Respondents who give an unsatisfactory report mark (5 or lower) to their first choice among the six vignettes;
3. Respondents who do rank the six vignettes, but mark each of these vignettes with a zero (and do not accept any of the vignettes).

This third approach seems to give the most plausible definition of protest voters, since the other approaches do not necessarily imply protest votes, but could indicate that respondents simply do not accept the situation portrayed in the vignettes or do
not rate the vignettes positively.

Re 1]
CM protest voters could be described as respondents who are not willing to accept any of the six vignettes offered. In question 9 of the questionnaire respondents are asked to state which of the six vignettes they consider acceptable. Table 5.19 gives the responses to this question. If protest voters are defined as respondents who are not willing to accept any of the six vignettes offered, 17.8% (39 respondents) of the CM sample may be regarded as protest votes.

Table 5.19: Acceptability of the vignettes (n=216)*

<table>
<thead>
<tr>
<th>Acceptability of the vignettes</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only the first choice is acceptable</td>
<td>78 (35.6%)</td>
</tr>
<tr>
<td>First and second choice are acceptable</td>
<td>47 (21.5%)</td>
</tr>
<tr>
<td>First, second and third choice are acceptable</td>
<td>36 (16.4%)</td>
</tr>
<tr>
<td>First up to fourth choice are acceptable</td>
<td>16 (7.3%)</td>
</tr>
<tr>
<td>First up to fifth choice are acceptable</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>All six vignettes are acceptable</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>None of the six vignettes is acceptable</td>
<td>39 (17.8%)</td>
</tr>
</tbody>
</table>

* Sample size of 219 minus three non-responses. Due to this non-response the percentages do not add up to 100%.

Re 2]
Secondly, protest voters could be identified as those respondents who gave an unsatisfactory report mark (5 or lower) to their first choice among the six vignettes. According to this definition, 11 respondents can be classified as protest voters (5.0%). Note that this percentage is lower than the 17.8% mentioned above.

Re 3]
Finally, protest voters in the CM sample could be defined as respondents who do rank the six vignettes, but mark each of these vignettes with a zero (and do not accept any of the vignettes). This type of inconsistent behaviour was described in section 5.5. Four respondents fit into this category of protest voters (1.8%), which is less than the two figures given above.

To test whether the percentage of protest voters \( pv \) is significantly lower in the CM sample, a z-test on percentages is performed. We take the highest percentage of protest voters in the CM sample, namely 17.8%, and compare this to the \( pv \) of 34.6% in the CVM sample. It follows that \( z_c = -3.8754 \), which lies in the critical region.
Consequently, the percentage of protest voters is significantly smaller in the CM sample ($H_a: \rho \nu^{CVM} - \rho \nu^{CM} < 0$).

This tentative comparison of the number of protest votes seems to indicate that the conjoint measurement type of questioning yields significantly less protest votes than does the direct way of questioning as used in contingent valuation.

Taking both this result and the response and non-response results of section 5.5 into consideration, it seems justified to accept the hypothesis that respondents find it easier and more acceptable to rank a set of alternatives (as in CM) than to state an absolute number (as in the CVM). Or, at the least, it seems safe to conclude that questions in terms of vignettes (CM) are as easy to answer and as acceptable to respondents as are direct valuation questions (CVM).

5.11.3 CVM-vignette in Conjoint Measurement Study

Every respondent in the conjoint measurement experiment receives a so-called contingent valuation vignette. This CVM-vignette is a vignette with exactly the same information about the good under valuation as the respondent in the CVM survey receives:

- The loss of recreation and nature values will be fully compensated (e.g., no over- or undercompensation), or, in terms of the vignettes, $\Delta N_j = 0$ and $\Delta R_j = 0$;
- The monetary contribution to the IJmeer Fund is the same as in the CVM questionnaire, $\Delta P_j \in \{2.50, 5, 10, 15, 25\}$.

An example of a CVM-vignette is presented in figure 5.3.

Figure 5.3: An example of a CVM-vignette

<table>
<thead>
<tr>
<th>Situation Z</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nature</strong>: the quantity of plants and animals in the IJmeer stays the same</td>
</tr>
<tr>
<td><strong>Recreation</strong>: the possibilities for water sports and other forms of recreation stay the same</td>
</tr>
<tr>
<td><strong>One-time contribution</strong>: $\text{f}10$</td>
</tr>
</tbody>
</table>
It is interesting to see whether, on the basis of the CVM-vignettes, respondents to the CVM survey state a different WTP than the CM respondents.

Every CM respondent received 6 vignettes, one of which was a CVM-vignette. The CM respondents successively order the 6 vignettes, give each of them a report mark and indicate whether a particular vignette is acceptable to them. The question now is which responses to include when determining the mean WTP from the CVM-vignettes. Here, three possible approaches are proposed to determine the appropriate CM subsamples.

1. Acceptable CVM-vignettes
The first CM subsample consists of respondents who indicated that they accept the CVM-vignette. Their mean WTP is $f11.59$ ($n_1=63$).

2. CVM-vignettes with a report mark of 6 or higher
The second CM subsample consists of respondents who gave a report mark of 6 or higher (on a 0 to 10 scale) to the CVM-vignette. The mean WTP for this second subsample is $f12.54$ ($n_2=84$).

3. Acceptable CVM-vignettes with a report mark of 6 or higher
The third CM subsample consists of a combination of the first two subsamples (e.g., respondents who accept the CVM-vignette and give a report mark of 6 or higher). The mean WTP is $f12.41$ ($n_3=54$).

The results are recapitulated in the following table.

| Table 5.20: Mean WTP on the basis of CVM-vignettes compared to CM results |
|-----------------------------|-----------------|-----------------|-----------------|
|                            | Mean WTP | Standard deviation | Sample size |
| CVM subsample              |            |                  |               |
| n of 219 minus 66 protest votes minus 6 non-response | $f8.62$ | 12.0686 | $n=119$ |
| CM subsample                            | Mean WTP | Standard deviation | Sample size |
| Acceptable CVM-vignettes | $f11.59$ | 6.3230 | $n_1=63$ | t-value: -1.82 |
| CVM-vignettes with report mark $\geq 6$ | $f12.54$ | 6.9675 | $n_2=84$ | t-value: -2.68 |
| Acceptable CVM-vignettes with mark $\geq 6$ | $f12.41$ | 6.3705 | $n_3=54$ | t-value: -2.17 |

It is obvious from the table that the mean WTP amounts based on the CM subsamples are larger than the mean WTP amount based on the CVM sample. Next, a t-test on the difference between the two means is performed, to test the hypothesis that the mean WTP based on CVM-vignettes is equal to the mean WTP on the basis
of the contingent valuation results (see e.g., Harnett, 1982, pp. 378-381). It follows that the mean WTP based on the contingent valuation sample \( f8.62 \) differs significantly on a 5% level from the mean WTP in the second and the third CM subsample (t-values of -2.68 and -2.17, respectively). However, the mean WTP in the first subsample can be considered equal to \( f8.62 \) (t-value of -1.82).

5.12 Conclusions

The aim of this study is twofold, one theoretical and one practical.

The practical aim is to find a price tag for the changes in the natural environment and the recreational possibilities in and around the IJmeer when IJburg will be built. In more economic terms: what is the monetary equivalent for the changes in utility of Amsterdam residents caused by the loss of nature and recreation values if IJburg is built?

The results of the contingent valuation survey show that an average Amsterdam resident is willing to pay \( f8.62 \) to the IJmeer Fund which will pay for projects to restore nature and recreation values. Summed for the total Amsterdam population, this amounts to \( f3.4 \) million.

The conjoint measurement result cannot be presented in a one-dimensional figure, since CM measures specific trade-offs between various aspects of the construction of IJburg. On the one hand, we have the quantity of plants and animals in the IJmeer (nature) and the possibilities for water sports and other forms of recreation (recreation), and on the other hand we have the contribution to the IJmeer Fund (price). The price change can only be determined for specific changes in the variables nature and recreation. For instance, if the variables nature and recreation both increase by 3.85% and we depart from the price equation based on the analysis of the report marks, the corresponding mean WTP would be \( f8.62 \), which matches the CVM result. The CM result indicates that the residents value nature higher than they value recreation.

The theoretical aim is to inquire into the differences between two monetary valuation methods, namely the well-known contingent valuation method on the one hand and conjoint measurement on the other hand. The inquiry departed from the following conjecture (formulated in section 5.2):
Conjoint measurement is at least as useful as the contingent valuation method when pricing environmental goods.

The conjecture is tested in terms of the following two hypotheses.

**Hypothesis I**
Respondents find it easier and more acceptable to give an order of alternatives (a relative valuation, as in CM) than to state an absolute number (as in the CVM).

Based on the results found in this study as summarised below, it seems justified to accept this hypothesis. Or, at the least, it seems safe to conclude that questions in terms of vignettes (CM) are as easy to answer and as acceptable to respondents as are direct valuation questions (CVM).

1. Response rates are higher for the CM sample than for the CVM sample (36.4% versus 31.7%);
2. Non-response concerning the valuation questions is lower for CM respondents, that is, for two out of the three valuation questions in the CM survey (ranking and acceptability). For the report-mark question, non-response is much higher, as is the rate of inconsistent behaviour, implying that some people feel that they are asked the same question again. In short, the response figures concerning the valuation questions are mixed, but do certainly not suggest that CVM outperforms CM.
3. The number of protest votes is significantly smaller in the CM sample than in the CVM sample: depending on the definition of protest votes, the CM sample includes between 4 (1.8%) and 39 (17.8%) protest votes, whereas the CVM sample includes 66 (34.6%) protest votes.

**Hypothesis II**
The results of the contingent valuation method are comparable to the results of conjoint measurement.

Hypothesis II can be tested by comparing the results of the CVM survey with the answers of CM respondents to the so-called CVM-vignette. Every respondent in the CM experiment received such a CVM-vignette. This is a vignette with exactly the same information as the respondent in the CVM survey has to evaluate: the loss of recreation and nature values will be fully compensated (e.g., no over- or undercompensation), and the monetary contribution to the Jmeer Fund is the same. Since respondents evaluate exactly the same good, it is possible to examine differences between the monetary results of the two methods. In section 5.11.3 it was found that the WTP was
The IJburg Experiment: CVM versus Conjoint Measurement

(significantly) higher in the CM sample, namely between f12 and f12.50, versus the CVM result of f8.62.

Other, more general, hypotheses were also tested in this study.

**Hypothesis III**
The sequence of answer categories does not have an unintentional effect on the answers given by respondents. In other words, it is hypothesised that order effects are not present.

Order effects in the answer categories of question 1 and 4 were tested in section 5.8. We found that the null hypothesis of no order effects was only rejected for the percentage of people willing to spend more money on foreign aid. All other percentages (32 possible order effects) can be considered equal on a 5% significance level. In question 4 none of the percentages differed significantly over the 5 versions (7 possible order effects). Evidently, order effects are not an issue in this study.

**Hypothesis IV**
Non-use values related to IJburg or the IJmeer are positive. This hypothesis is accepted if people who do not currently use IJburg or the IJmeer to live, recreate or enjoy nature, and do not intend to do so in the future, have a positive valuation for the IJmeer Fund.

Since CM is an indirect method, it is very complicated to divide total value into a use part and a non-use part. The CVM results, however, can easily be split into various value components. At the end of section 5.9.1 the non-use value was determined to be f7.21. The mean WTP of the respondents who do currently use the IJmeer is f10.06. By subtracting these amounts, the ‘pure’ use value is computed. This amounts to f2.85, which is far less than the non-use value of f7.21. Apparently, the idea of an unaffected IJmeer is more valuable than the use of the IJmeer for recreational or other purposes.

**Hypothesis V**
The CVM elicitation method (namely: “Are you willing to pay fx?”) invokes a starting-point bias.

In section 5.9.3, clear evidence was found that a strong starting-point bias does indeed exist in this study, that is, the valuations stated by the CVM respondents differed significantly over the five versions (each with a different starting-point fx). It is important to note that CM most likely does not invoke a starting-point bias.
Conclusions
In this particular study, conjoint measurement did not give a simple clear-cut result, i.e., the exact price could not be determined since the exact consequences of the construction of IJburg on the attributes nature and recreation are not known in advance. However, if the ‘before’ and ‘after’ situation in terms of the attributes are known, CM can also provide a monetary equivalent corresponding to the change.

CM has at least two advantages over the CVM. The first is that CM also gives an idea of the relative importance of the attributes. The second is that the CM result is more flexible than the CVM result, because the CVM result is a one-dimensional figure whereas the CM result entails a price equation with the attributes as variables, which allows for the calculation of many different potential changes. In this case of IJburg, the two form an interesting couple: the CVM measures the total value, whereas CM provides an insight into the importance of the attributes.

In summary, the study shows that conjoint measurement is a useful and valid valuation method. Respondents seem to like the indirect way of questioning as used in conjoint measurement better than the direct way of questioning as used in the contingent valuation method. Conjoint measurement is, at the least, an important complement to contingent valuation.
Endnotes

1 The original quote is in Dutch. Translation by Ada Kromhout.

2 The survey was sponsored by the Institute of Economic Geography of the University of Amsterdam (EGI). I especially thank Jan Lamboooy for this financial support. I also thank Ada Kromhout who helped me with many practical things, and Peter Hop who helped with part of the analysis of the CM results.

3 In 1996 prices. Source: AT5 teletext (18/3/97) and verbal information from Projectbureau IJburg (March 24, 1997, Herman Groot).

4 The amount to be spent on recreation (ƒ65 million) is divided into five portions: ƒ15 million to be spent on the construction of beaches, ƒ30 million on the building of yacht-basins, ƒ8 million on laying out sports fields, ƒ7 million on laying out parklands, and ƒ5 million on laying out cycle paths. The expenditures for nature (ƒ36 million in all) is divided into 4 portions: ƒ9 million for clearing away a longitudinal embankment up to the water line, ƒ16 million on the construction of nature-friendly shores, ƒ7 million on laying out parklands, and ƒ4 million on laying out nature reserve areas.

5 For instance, the Volkskrant (6/2/97) and the Haarlems Dagblad (28/2/97) stated that it is a "Fund for the development of nature reserves around the islands of IJburg in the IJmeer".

6 NOAA is short for National Oceanic and Atmospheric Administration, which is a US government institution. See chapter 3, section 3.4.

7 For instance, response rates are often higher for people with a higher education and a better income position (Mitchell and Carson, 1989). This is also apparent from this survey (cf. section 5.6).

8 This is the reason why these inconsistent answers were deleted from the analysis based on report marks in section 5.10, but were included in the other two analyses based on rankings and acceptability.

9 A simple t-test is performed to test the hypothesis that the mean net monthly household income differs between the sample and the population (t = 13.29).

10 Although the percentages for the 35-49 age category seem to differ somewhat, this difference is not statistically significant on a 5% level (z-value = 1.847, which lies outside the critical region).

11 For instance, they will not live in IJburg, or they will not take a walk around the IJmeer, or they will not photograph the birds living in the IJmeer area, or they will not sail on the IJmeer.

12 Other specifications are possible as well. However, the specification presented in the main text gives the best results in terms of theoretical validity and t-values. An example of an alternative specification is the inclusion of logarithmic variables (t-values between { }, full names of the variables are given in the main text):

\[ WTP = -14.42 + 0.12 \ln(y) + 7.29e - 1.22(s) - 2.54(f) + 11.53(ch) + 7.79(pref) - 4.58(pos) + 4.11(des) \]

\[ \{ -2.04 \} \{ -2.62 \} \{ -3.16 \} \{ -0.53 \} \{ -1.66 \} \{ 2.50 \} \{ 2.09 \} \{ -2.11 \} \{ 1.61 \} \]

13 The stochastic terms \( \varepsilon_i \) are assumed to be independently and identically distributed extreme value random variates (Weibull distribution).

14 Of course, a vignette cannot be marked lower than 0, but the model specifies this probability as lower than or equal to 0 (≤ 0). The reason for this is that cumulative probabilities are modeled.

15 Other specifications are possible as well. However, the specification presented in the main text gives the best results in terms of validity and t-values. An example of an alternative specification is the inclusion of logarithmic variables (t-values between { }, full names of the variables are given in the
main text, \( RM^* \) is the empirically transformed report mark variable):

\[
RM^* = -1.66 + 0.02(N) - 0.02(P) + 0.01(R) + 0.005(\ln(y)\ln(a)) + 0.23\ln(y) - 0.09(e) + 0.02(s) + \rightarrow
\]

\[
\begin{array}{cccccc}
-4.40 & 24.19 & -7.09 & 6.17 & 0.64 & 4.77 \\
-1.72 & 0.43 & -0.22\ln(f) + 0.18(ch) + 0.33(env) - 0.17(move) - 0.26(live) \\
-2.85 & 2.10 & 1.99 & -3.04 & -4.76
\end{array}
\]