Information, consequentiality and credibility in stated preferences
A choice experiment on climate adaptation

EAERE 2020
25-06-2020

Malte Welling
IÖW – Institute for Ecological Economy Research, Berlin
Brandenburg University of Technology, Chair for Environmental Economics, Cottbus

Ewa Zawojska
University of Warsaw, Faculty of Economic Sciences, Warsaw

Julian Sagebiel
Technische Universität Berlin, Institute for Landscape Architecture and Environmental Planning, Berlin
Information in stated preferences

- In stated preference surveys, respondents are usually provided information about the scenario and the good to be valued before preference elicitation.

- Type and amount of information provided matters for the validity of value estimates.
  
  \[(\text{Mitchell and Carson, 1989; Blomquist and Whitehead, 1998; Johnston et al., 2017})\]

- Extensive research on effects of information scripts:
  
  - Many find information scripts matter for value estimates. Additional information often increases willingness to pay.
    
    \[(\text{Munro and Hanley, 2001; Bateman and Mawby, 2004; Czajkowski et al., 2016})\]
  
  - But some report mixed findings.
    
    \[(\text{Hoevenagel and Linden, 1993; MacMillan et al., 2006; Needham et al., 2018})\]

\[\rightarrow\] Better understanding of the mechanisms of information effects can deliver important insights for stated preference practitioners.
Information, consequentality, credibility

Additional information scripts

Learning:  
e.g. Munro & Hanley (2001)

Availability heuristic:  
e.g. Hoevenagel & Linden (1993)

Context effect:  
e.g. Liebe et. al (2016)

Experimenter demand effect:  
e.g. Zizzo (2009)

Willingness to pay
Information, consequentiality, credibility

**Perceived consequentiality:**
Does the survey outcome influence the decision of policymakers?

Higher WTP when perceived as more consequential:
e.g. Groothuis et al. (2017)
Vossler & Holladay (2018)

Willingness to pay
Information, consequentiality, credibility

Perceived credibility: Is the proposed extent of the increase in the attributes credible?

Higher WTP when perceived as more credible: Kataria et al. (2012)

Willingness to pay
Research question

Additional information scripts

**Learning:**
e.g. Munro & Hanley (2001)

**Availability heuristic:**
e.g. Hoevenagel & Linden (1993)

**Context effect:**
e.g. Liebe et al. (2016)

**Experimenter demand effect:**
e.g. Zizzo (2009)

**Perceived consequentiality:**
Does the survey outcome influence the decision of policymakers?

**Perceived credibility:**
Is the proposed extent of the increase in the attributes credible?

Higher WTP when perceived as more consequential:
e.g. Groothuis et al. (2017)
Vossler & Holladay (2018)

Higher WTP when perceived as more credible:
Kataria et al. (2012)

Willingness to pay
Research question

Can shifts in the perceptions explain part of information effects?
To examine this, we address these questions:

Additional information scripts

Perceived consequentiality:
Does the survey outcome influence the decision of policymakers?

Learning:
e.g. Munro & Hanley (2001)

Availability heuristic:
e.g. Hoevenagel & Linden (1993)

Context effect:
e.g. Liebe et al. (2016)

Experimenter demand effect:
e.g. Zizzo (2009)

Perceived credibility:
Is the proposed extent of the increase in the attributes credible?

Higher WTP when perceived as more consequential:
e.g. Groothuis et al. (2017)
Vossler & Holladay (2018)

Higher WTP when perceived as more credible:
Kataaria et al. (2012)

Willingness to pay
Research question

Can shifts in the perceptions explain part of information effects? To examine this, we address these questions:

(1) Does the additional information script affect stated preferences?

Perceived consequentiality: Does the survey outcome influence the decision of policymakers?

- Higher WTP when perceived as more consequential: e.g. Groothuis et al. (2017) Vossler & Holladay (2018)

Perceived credibility: Is the proposed extent of the increase in the attributes credible?

- Higher WTP when perceived as more credible: Kataria et al. (2012)

Learning: e.g. Munro & Hanley (2001)

Availability heuristic: e.g. Hoevenagel & Linden (1993)

Context effect: e.g. Liebe et. al (2016)

Experimenter demand effect: e.g. Zizzo (2009)

Willingness to pay
Research question

Can shifts in the perceptions explain part of information effects? To examine this, we address these questions:

1. Does the additional information script affect stated preferences?
2. Does the additional information script affect perceptions?

Perceived consequentiality: Does the survey outcome influence the decision of policy makers?

Availability heuristic: e.g. Hoevenagel & Linden (1993)

Context effect: e.g. Liebe et al. (2016)

Experimenter demand effect: e.g. Zizzo (2009)

Perceived credibility: Is the proposed extent of the increase in the attributes credible?

Higher WTP when perceived as more consequential: e.g. Groothuis et al. (2017) Vossler & Holladay (2018)

Higher WTP when perceived as more credible: Kataria et al. (2012)

Willingness to pay

Perceived consequentiality:

Does the survey outcome influence the decision of policy makers?

Availability heuristic: e.g. Hoevenagel & Linden (1993)

Context effect: e.g. Liebe et al. (2016)

Experimenter demand effect: e.g. Zizzo (2009)

Perceived credibility:

Is the proposed extent of the increase in the attributes credible?

Higher WTP when perceived as more consequential: e.g. Groothuis et al. (2017) Vossler & Holladay (2018)

Higher WTP when perceived as more credible: Kataria et al. (2012)

Willingness to pay
Research question

Can shifts in the perceptions explain part of information effects? To examine this, we address these questions:

(1) Does the additional information script affect stated preferences?
(2) Does the additional information script affect perceptions?
(3) Do stated preferences vary with perceptions?

Perceived consequentiality:
Does the survey outcome influence the decision of policymakers?

Perceived credibility:
Is the proposed extent of the increase in the attributes credible?

Higher WTP when perceived as more consequential:
- e.g. Groothuis et al. (2017)
- Vossler & Holladay (2018)

Higher WTP when perceived as more credible:
- Kataria et al. (2012)

Context effect:
- e.g. Liebe et al. (2016)

Experimenter demand effect:
- e.g. Zizzo (2009)

Willingness to pay

Perceived consequentiality:
- Does the survey outcome influence the decision of policymakers?
Research question

Can shifts in the perceptions explain part of information effects? To examine this, we address these questions:

1. Does the additional information script affect stated preferences?
2. Does the additional information script affect perceptions?
3. Do stated preferences vary with perceptions?
4. Can part of the information effect be assigned to shifts in perceptions?

Perceived consequentiality:
Does the survey outcome influence the decision of policymakers?

Perceived credibility:
Is the proposed extent of the increase in the attributes credible?

Higher WTP when perceived as more consequential:
e.g. Groothuis et al. (2017)
Vossler & Holladay (2018)

Higher WTP when perceived as more credible:
Kataria et al. (2012)

Willingness to pay

Higher WTP when perceived as more consequential:
e.g. Groothuis et al. (2017)
Vossler & Holladay (2018)
Case study

- The city of Bremen adopted a climate adaptation strategy that contains urban green measures for climate adaptation: street trees, green spaces, green roofs
- Choice experiment with the urban green adaptation measures as attributes
- April – May 2019
- Computer-Assisted Web Interviews
- Sample: 1,178 residents of Bremen and surroundings
Study design: choice tasks

9 choice tasks per respondent:

<table>
<thead>
<tr>
<th>Street trees</th>
<th>Combination A</th>
<th>Combination B</th>
<th>Current state</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 1 tree per 100 meters of a street</td>
<td>+ 2 trees per 100 meters of a street</td>
<td>As today</td>
<td></td>
</tr>
</tbody>
</table>

| Green areas | + 1% of the city area is green spaces | As today | As today |

| Extensive green roofs | + 5 out of 100 roofs are extensive green roofs | + 10 out of 100 roofs are extensive green roofs | As today |

| Intensive green roofs | As today | + 2 out of 100 roofs are intensive green roofs | As today |

| Cost for you per year | €20 | €5 | €0 |

| Which option do you choose? | □ | □ | □ |

Note: The tasks were originally displayed in German.
Study design: treatment

All respondents were provided with information about the attributes and their benefits.
Half of respondents were provided an additional information script:

No Script sample

The first part of this survey focuses on possible urban green measures for the city of Bremen.

Script sample

The Senate of Bremen adopted the climate change adaptation strategy for Bremen in April 2018. The strategy document explains the consequences of climate change for the city of Bremen. Strong rain, river and storm floods will become more likely. The strategy document predicts a rising risk of flooding with property damages, such as flooded basements and underground garages. Also heat waves will become more likely according to the strategy document. These can reduce your productivity and strain your cardiovascular system.

The climate change adaptation strategy mentions several measures which the city of Bremen could apply. The first part of this survey focuses on some of these measures.
Study design: elicitation of perceptions

Two consequentiality perception indicators:

Policy consequentiality: “To what degree do you believe that your responses will affect which measures will be implemented in the city of Bremen?”

Payment consequentiality: “To what degree do you believe that your responses will affect whether you will have to pay the additional cost if the measures are implemented?”

Six-point Likert scale “I strongly believe” – “I do not believe at all” and “I do not know”

Four credibility perception indicators:

For each of the four non-cost attributes: “How likely do you think it is that the proposed extent of the changes can actually be realized?”

Six-point Likert scale “very likely” – “very unlikely” and “I do not know”
Econometric approach

Model I: Mixed Logit in willingness to pay space
- Script interactions with the mean preference parameters

Model II: Hybrid Mixed Logit in willingness to pay space

- Measurement equations: Ordered Probit
  Latent Variable 1 as explanatory variable for credibility indicators
  LV 2 as explanatory variable for consequentiality indicators

- Structural equations: Linear regression
  Information script as explanatory variable for both latent variables

- Choice model: Mixed Logit in willingness to pay space
  Latent variable interactions with mean preference parameters
  Script interactions with the mean preference parameters
  \( \rightarrow \) Comparison between Model I & Model II

(1) Does the additional information script affect stated preferences?
(2) Does the additional information script affect perceptions?
(3) Do stated preferences vary with perceptions?
(4) Can part of the information effect be assigned to shifts in perceptions?
## Results

<table>
<thead>
<tr>
<th></th>
<th>Model I: Mixed Logit WTP space</th>
<th>Model II: Hybrid Mixed Logit WTP space</th>
</tr>
</thead>
<tbody>
<tr>
<td>LL at convergence</td>
<td>-7854</td>
<td>-17256</td>
</tr>
<tr>
<td>LL at constants only</td>
<td>-11442</td>
<td>-21410</td>
</tr>
<tr>
<td>McFadden’s pseudo-R²</td>
<td>0.314</td>
<td>0.194</td>
</tr>
<tr>
<td>Ben-Akiva-Lerman’s pseudo-R²</td>
<td>0.495</td>
<td>0.494</td>
</tr>
<tr>
<td>AIC/n</td>
<td>1.488</td>
<td>3.270</td>
</tr>
<tr>
<td>BIC/n</td>
<td>1.511</td>
<td>3.323</td>
</tr>
<tr>
<td>Observations</td>
<td>10602</td>
<td>10602</td>
</tr>
<tr>
<td>Respondents</td>
<td>1178</td>
<td>1178</td>
</tr>
<tr>
<td>parameters</td>
<td>33</td>
<td>77</td>
</tr>
</tbody>
</table>

Estimation method for both models: simulated maximum likelihood with 10,000 Sobol draws
## Results: information effect on preferences

### Model I: Mixed Logit in WTP space

<table>
<thead>
<tr>
<th>Feature</th>
<th>Mean WTP</th>
<th>Standard Deviations</th>
<th>script interaction for means</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Street trees</strong></td>
<td>29.12 (2.42) ***</td>
<td>47.82 (2.47) ***</td>
<td>7.47 (3.12) **</td>
</tr>
<tr>
<td>(+1 per 100 meter street)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Extensive green roofs</strong></td>
<td>1.74 (0.42) ***</td>
<td>3.96 (0.44) ***</td>
<td>0.78 (0.48)</td>
</tr>
<tr>
<td>(+1 of 100 roofs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intensive green roofs</strong></td>
<td>11.64 (1.95) ***</td>
<td>22.58 (2.12) ***</td>
<td>4.51 (2.30) *</td>
</tr>
<tr>
<td>(+1 of 100 roofs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Green space</strong></td>
<td>23.35 (2.88) ***</td>
<td>52.17 (2.88) ***</td>
<td>6.57 (3.71) *</td>
</tr>
<tr>
<td>(+ 1 % of city area)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Status quo</strong></td>
<td>-20.28 (1.03) ***</td>
<td>23.64 (1.16) ***</td>
<td>-7.48 (1.12) ***</td>
</tr>
<tr>
<td><strong>Cost (1000 EUR)</strong></td>
<td>3.00 (0.06) ***</td>
<td>1.10 (0.07) ***</td>
<td>-0.10 (0.07)</td>
</tr>
</tbody>
</table>

***, **, and * indicate 1%, 5%, and 10% significance levels, respectively. Standard errors are given in brackets.

(1) **Does an additional information script affect stated preferences?**
- In the script sample, WTP for attributes is larger and disutility from the status quo higher
- But only for status quo the effect is strongly significant
Results: information effect on perceptions

Model II: Hybrid mixed logit – Structural equations

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>LV 1 (credibility)</th>
<th>LV 2 (consequentiality)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information script</td>
<td>-0.084 (0.035) **</td>
<td>-0.041 (0.040)</td>
</tr>
</tbody>
</table>

***, **, and * indicate 1%, 5%, and 10% significance levels, respectively. Standard errors are given in brackets.

(2) Does an additional information script affect perceptions?
- The information script strengthens perceived credibility significantly.
- The information script does not strengthen perceived consequentiality significantly.
### Results: role of perceptions for preferences

<table>
<thead>
<tr>
<th></th>
<th>Mean WTP</th>
<th>Standard Deviations</th>
<th>LV 1 interaction for means</th>
<th>LV 2 interaction for means</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Street trees</strong> (+1 per 100 meter street)</td>
<td>28.57 (2.85) ***</td>
<td>45.96 (2.51) ***</td>
<td>- 8.55 (2.03) ***</td>
<td>- 10.05 (2.32) ***</td>
</tr>
<tr>
<td><strong>Extensive green roofs</strong> (+1 of 100 roofs)</td>
<td>1.82 (0.44) ***</td>
<td>3.74 (0.44) ***</td>
<td>- 1.07 (0.30) ***</td>
<td>- 0.85 (0.34) ***</td>
</tr>
<tr>
<td><strong>Intensive green roofs</strong> (+1 of 100 roofs)</td>
<td>11.89 (2.19) ***</td>
<td>23.24 (2.62) ***</td>
<td>- 4.40 (1.68) ***</td>
<td>- 4.79 (1.77) ***</td>
</tr>
<tr>
<td><strong>Green space</strong> (+ 1 % of city area)</td>
<td>23.82 (3.19) ***</td>
<td>50.02 (2.55) ***</td>
<td>- 10.35 (2.44) ***</td>
<td>- 10.05 (2.32) ***</td>
</tr>
<tr>
<td><strong>Status quo</strong></td>
<td>- 20.14 (1.15) ***</td>
<td>21.48 (1.21) ***</td>
<td>6.24 (0.82) ***</td>
<td>6.55 (0.86) ***</td>
</tr>
<tr>
<td><strong>Cost (1000 EUR)</strong></td>
<td>2.99 (0.06) ***</td>
<td>1.07 (0.08) ***</td>
<td>0.10 (0.04) **</td>
<td>0.22 (0.05) ***</td>
</tr>
</tbody>
</table>

***, **, and * indicate 1%, 5%, and 10% significance levels, respectively. Standard errors are given in brackets.

(3) Do stated preferences vary with perceptions?  
Strong credibility and consequentiality perceptions are associated with larger WTP for attributes and higher disutility from the status quo.
## Results: assessing the perceptions pathway

<table>
<thead>
<tr>
<th>Model I</th>
<th>Model II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mixed Logit in WTP space</strong></td>
<td><strong>Hybrid Mixed Logit in WTP Space</strong></td>
</tr>
<tr>
<td><strong>Mean WTP</strong></td>
<td><strong>Mean WTP</strong></td>
</tr>
</tbody>
</table>
| **Street trees**  
(+1 per 100 meter street) | 29.12 (2.42) *** | 7.47 (3.12) ** | 28.57 (2.85) *** | 6.43 (3.56) * |
| **Extensive green roofs**  
(+1 of 100 roofs) | 1.74 (0.42) *** | 0.78 (0.48) | 1.82 (0.44) *** | 0.56 (0.53) |
| **Intensive green roofs**  
(+1 of 100 roofs) | 11.64 (1.95) *** | 4.51 (2.30) * | 11.89 (2.19) *** | 3.67 (2.66) |
| **Green space**  
(+ 1 % of city area) | 23.35 (2.88) *** | 6.57 (3.71) * | 23.82 (3.19) *** | 5.41 (4.02) |
| **Status quo**  
- | -20.28 (1.03) *** | -7.48 (1.12) € *** | -20.14 (1.15) *** | -6.32 (1.44) *** |
| **- Cost (1000 EUR)**  
- | 3.00 (0.06) *** | -0.10 (0.07) | 2.99 (0.06) *** | -0.09 (0.08) |

### (4) Can part of the information effect be assigned to shifts in perceptions?
- Script coefficient is smaller when accounting for perceptions in Model II for all attributes and SQ, but difference is small and not statistically significant.
- Robust difference between Script and No script sample remains at least for status quo.
Results: summary

- Information effect is present: larger disutility from status quo, larger WTP for (at least some) attributes

- Our information script does not significantly affect perceived consequentiality
  - Not very surprising: even with targeted consequentiality scripts mixed findings about effect on consequentiality statements

- We can not confirm a credibility perceptions pathway in information effects, but find some indications for a small role:
  - Information script strengthens credibility perceptions
  - Credibility perceptions affect preferences
  - Accounting for perceptions might weakly decrease information effect
Discussion

- More differentiated or extreme versions of script might give additional insight
  - Size of information effects can depend on factors like style of the information script and how extreme the script is
  - these could also influence the mechanism of information effects

- Endogeneity of perceptions as explanatory variables: Hybrid mixed logit model controls for measurement error, but not reverse causality or ommitted variables

- We used one latent variable for credibility perceptions and one for consequentiality perceptions: Previous research suggests two separate ones for policy and payment consequentiality. In our models, second LV for consequentiality seemed not to capture anything more.
Thank you.

Malte Welling
malte.welling@ioew.de
IÖW – Institute for Ecological Economy Research, Berlin
Brandenburg University of Technology, Chair of Environmental Economics, Cottbus
malte.welling@ioew.de

Ewa Zawojska
University of Warsaw, Faculty of Economic Sciences, Warsaw
ewa.zawojska@uw.edu.pl

Julian Sagebiel
Technische Universität Berlin, Institute for Landscape Architecture and
Environmental Planning, Berlin
sagebiel@tu-berlin.de
References (1)


References (2)


