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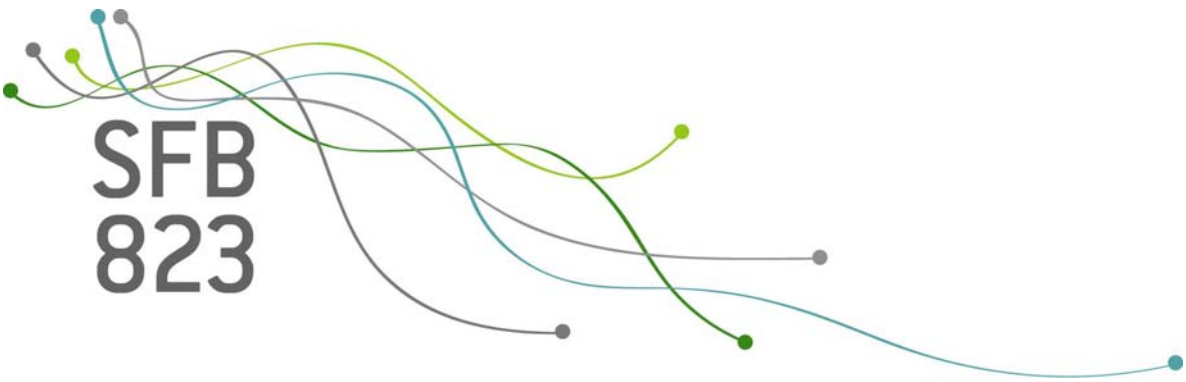

Consequentiality and the Willingness-To-Pay for Renewables: Evidence from Germany

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Abstract. Based on hypothetical responses originating from a large-scale survey among about 7,000 German households, this study investigates the discrepancy in willingness-to pay (WTP) estimates for green electricity across discrete-choice and open-ended valuation formats, thereby accounting for perceived consequentiality: respondents self-select into two groups distinguished by their belief in the consequentiality of their answers for policy making. Recognizing that consequentiality status and WTP might be jointly influenced by unobservable factors, we employ a switching regression model that accounts for the potential endogeneity of respondents' belief in consequences and, hence, biases from sample selectivity. Contrasting with the received literature, we find WTP bids that tend to be higher among those respondents who obtained questions in the open-ended format, rather than single binary choice questions. This difference shrinks, however, when focusing on individuals who perceive the survey as politically consequential.

Key words: Elicitation Format, Contingent Valuation.

JEL classification: D03, D12, Q48, Q50, H41.

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1 Introduction

Non-market goods, such as reductions in air pollution, are typically valued on the basis of willingness-to-pay (WTP) bids. Being indispensable for gauging the welfare implications of alternative policy options, WTP estimates, ideally, rely on revealed, rather than stated preferences (Harrison, 2006, p. 125). Frequently, however, revealed-preference information is unavailable, with one reason being the lack of markets (Blumenschein et al., 2008, p. 114). Another reason for the absence of such information owes to market interventions that distort price signals.

A particular deficit with respect to revealed-preference information pertains to electricity produced on the basis of renewable energy technologies (Andor et al., 2017), called here green electricity. In Germany, this is due to the fact that contracts on the delivery of green electricity are often cheaper than those for conventional electricity, although the cost of renewable electricity production is generally higher. This circumstance owes to cheap imports of green electricity produced on the basis of competitive water power and prevents researchers from receiving comprehensive information on consumers' true preferences. As nobody can be excluded from the associated benefits for which there is no rivalry, green electricity is an example for a public good (see e. g. Menges et al., 2005, p. 432).

In the absence of empirical evidence on revealed preferences, researchers widely employ stated-preference (SP) methods to elicit the value of non-market goods on the basis of hypothetical choices. One commonly employed SP approach is the contingent-valuation method (CVM), which allows for eliciting passive-use values, that is, economic benefits that are not directly experienced by respondents. Applying this approach appears to be particularly appropriate in the case of green electricity, as the benefits from curbing greenhouse gas emissions may be largely determined by passive-use values arising from bequests to future generations (Whitehead and Cherry, 2007, p. 248).

Although SP methods are favored theoretically for their ability to measure total

economic value, their external validity remains the subject of much debate (Vossler and Watson, 2013). In fact, there is ample empirical evidence that SP studies may suffer from hypothetical bias, as has been documented extensively in the literature (see e. g. Bishop and Heberlein, 1979, as well as the reviews by Harrison, 2006, and Harrison and Rutström, 2008). To remove or, at least, reduce this bias, various techniques have been proposed, among which is the consequential-script corrective suggested by Bulte et al. (2005, p. 334).[1]

In addition, economic theory suggests that for incentive compatibility, i. e. the incentive to truthfully reveal preferences, consequentiality is needed (Carson and Groves, 2007; Carson et al., 2014; Vossler et al., 2012; Vossler and Holladay, 2016). Vossler and Watson (2013) are the first who compare SP responses with the outcome of a parallel public referendum, demonstrating that the hypothetical bias in contingent valuation can be eliminated by focusing on those respondents who perceive their answer as consequential for policy making.

Accounting for perceived consequentiality and employing hypothetical responses originating from a large-scale survey among more than 7,000 German households, this study investigates the discrepancy in WTP bids for green electricity across discrete-choice and open-ended valuation formats, the two most common methods to elicit WTP values. To this end, an ex-post procedure is applied that endogenously divides respondents into two groups distinguished by their belief in the consequentiality of their answers for policy making. Recognizing that consequentiality status and WTP might be jointly influenced by unobservable factors, we employ a switching regression model that accounts for the potential endogeneity of respondents' belief in consequences and, hence, biases from sample selectivity. Using an experimental design, our additional aim is to gauge the extent to which WTP estimates vary according to the ex-ante treatment in the form of a consequential script, which is crossed with the two WTP elicitation formats.

[1] Alternative techniques are the cheap-talk protocol introduced by Cummings and Taylor (1999) and the certainty approach conceived by Johannesson et al. (1998).

Among our major empirical results is the finding of a WTP for green electricity that tends to be higher among those respondents who received the open-ended question. This outcome contrasts with the literature (see Brown et al., 1996, for an overview): While there are significant differences in WTP bids across discrete-choice and open-ended contingent valuation studies (Kealy and Turner, 1993; Halvorsen and Sœlensminde, 1998), the majority of empirical analyses find WTP estimates that are higher for the discrete-choice than for the open-ended format. The difference in our WTP bids across the open-ended and discrete-choice format shrinks, however, when we focus on individuals who perceive the survey as politically consequential.

The following section provides a summary of the data and the survey design. Section 3 presents some descriptive results. Section 4 explains the methods applied, followed by the presentation of our empirical results in Section 5. The last section summarizes and concludes.

2 Data and Experimental Design

To elicit households' WTP for green electricity, we have employed both discrete-choice and open-ended questions, the two most widely used valuation formats in applied contingent valuation studies – see Ami et al. (2011), Andor et al. (2017) and Carlsson et al. (2011) for recent studies employing open-ended methods and Jobstvogt et al. (2014), Veronesi et al. (2014), as well as Whitehead and Cherry (2007) for analyses based on the discrete-choice format. In a discrete-choice setting, respondents are asked whether they would accept a given price for the good under scrutiny, whereas in the open-ended format respondents are asked what their maximum WTP for this good would be.

One advantage of the open-ended format over the discrete-choice method is that it provides information on the whole range of a respondents' WTP, whereas the discrete-choice method only yields information about whether an individual's WTP is below or above a certain threshold (Halvorsen and Sœlensminde, 1998). Therefore, discrete-

choice methods may perform very poorly if respondents' maximum WTP is much higher than the maximum amount included in the discrete-choice experiment (van der Pol et al., 2008). The relative advantage of the discrete-choice valuation method is that it alleviates incentives for survey respondents to strategically over- or understate their WTP (Arrow et al., 1993).

The survey was conducted in 2015 in collaboration with the survey institute *forsa*, which maintains a panel of more than 10,000 households that is representative for the German speaking population.[2] *forsa* collects data using a state-of-the-art tool that allows panelists to fill out the questionnaire using either a television or the internet. Respondents – in our survey the household heads – retrieve and return questionnaires from home and can interrupt and continue the survey at any time. A large set of socio-economic and demographic background information on all household members is available from *forsa*'s household selection procedure and updated regularly. Within the survey period of March 3 to April 29, 2015, 7,077 household heads completed the questionnaire.

Panelists are randomly divided into two groups of equal size, one of which is confronted with a consequential script, reported below.[3] Both groups are randomly divided into two equally large subgroups, whose members obtain a question on their WTP for green electricity in either the open-ended or the discrete-choice format. This yields a split-sample survey design as presented in Table 1, where the number and shares of individuals in each of the treatment groups is reported.

Both the discrete-choice question and the open-ended question are preceded by a brief introductory text that indicates the share of renewable energy in electricity production at the time of the survey, 28%, as well as the government's target of 35% by 2020. The text further notes the 6.17 cent surcharge for the support of renewable energies in 2015, the so-called EEG Levy, and includes the implications of this surcharge

[2]Information on the panel is available at `http://www.forsa.com/`.

[3]While there may be biases from ordering effects (see e. g. Carlsson et al., 2012), randomizing the draws of the alternatives should minimize such biases (Bateman and Langford, 1997; Clark and Friesen, 2008).

Table 1: **Experimental Design: Shares and Number of Observations in Treatment Groups**

		Consequential Script			
		No	Yes	Total	Shares
Discrete-Choice	1 Cent	552	534	1,086	33.8%
	2 Cents	525	537	1,062	33.1%
	4 Cents	528	536	1,064	33.1%
	Total	1,605	1,607	3,212	52.7%
Open-Ended		1,401	1,479	2,880	47.3%
Total		3,006	3,086	6,092	100.0%
Shares		49.3%	50.7%	100.0%	–

for the overall cost increase faced by a typical household over a year.

Respondents who are posed the open-ended question are then presented with the following text: "In order to reach the target of 35% renewable energy in the electricity mix in Germany, what is the maximum increase in the surcharge (in cents per kilowatt hour) that you would be willing to pay?" While this open-ended question principally allows for unlimited WTP bids, the discrete-choice question gauges the willingness to incur either of three pre-determined increases in the surcharge for the promotion of renewable energy technologies. In detail, the translation of the discrete-choice question reads: "Would you be willing to pay an additional X cents on the per kilowatt hour surcharge in order to reach the target of 35% renewable energy in the electricity mix by 2020?", where X is randomly replaced with either a 1, 2, or 4. Given the nearly 4-cents increase in the surcharge between 2010 and 2015, and anticipated further increases owing to the continued expansion of renewable capacity, the provided range seems a reasonable approximation of the cost increases that households are likely to face in the upcoming years.

As a result of our randomization procedure, for the discrete-choice format, we end up with three sub-groups that are of almost equal size (Table 1), thereby reflecting the original randomization. (Table A1 of the Appendix reports the means for the

Table 2: **Variable Definitions and Descriptive Statistics**

		Means	
Variable Name	Variable Definition	Open-Ended	Discrete Choice
Age	Age of respondent	55.2	55.4
Female	Dummy: 1 if respondent is female	0.352	0.329
Children	Dummy: 1 if respondent has children	0.704	0.703
College Degree	Dummy: 1 if household head has a college degree	0.321	0.312
Script	Dummy: 1 if household received a consequential script	0.500	0.500
Consequentiality	Dummy: 1 if respondent believes that surveys influence political decision making	0.591	0.608
1 Cent	Dummy: 1 if respondent was asked to accept a 1 Cent increase in the EEG Levy	0.331	0.333
2 Cents	Dummy: 1 if respondent was asked to accept a 2 Cent increase in the EEG Levy	0.340	0.333
4 Cents	Dummy: 1 if respondent was asked to accept a 4 Cent increase in the EEG Levy	0.330	0.333
Low income	Dummy: 1 if net monthly household income is lower than €1,200	0.083	0.082
Medium income	Dummy: 1 if net monthly household income is between €1,200 and €2,700	0.412	0.433
High income	Dummy: 1 if net monthly household income is between €2,700 and €4,200	0.334	0.313
Very high income	Dummy: 1 if net monthly household income exceeds €4,200	0.169	0.172
1-Person household	Dummy: 1 if # household members equals 1	0.269	0.275
2-Person household	Dummy: 1 if # household members equals 2	0.489	0.472
3-Person household	Dummy: 1 if # household members equals 3	0.132	0.130
$>$ 3-Person household	Dummy: 1 if # household members $>$3	0.109	0.123
More time	Dummy: 1 if respondent needs more time than the median duration to complete the survey	0.510	0.494

control variables across the three subgroups, indicating a successful randomization.) With largely equal shares of 47.3% and 52.7%, a somewhat stronger deviation from the originally random partition is observed for those sub-groups that either face the discrete-choice or the open-ended questions, while half of all respondents received a consequential script (50.7%).

Our consequential script is mainly inspired by Bulte et al. (2005) and condensed as much as possible to avoid that panelists ignore the script simply because of the time requirements for reading the text:

> "We would like to point out that this survey is part of a research project on behalf of the German Federal Ministry of Education and Research (BMBF). The results of this survey will be made available to policy makers and serve as a basis for future decisions, especially with respect to the future level of the surcharge for the promotion of renewable energy technologies (EEG Levy). To reach meaningful conclusions, it is therefore important that you provide exactly the amount that you actually would be willing to pay at most."

Finally, as economic theory suggests that consequentiality is needed for incentive compatibility (Carson and Groves, 2007; Vossler et al., 2012), we explore whether there are significant discrepancies in the WTP bids for those respondents who believe that their responses may have political consequences. To this end, upon stating their preferences in the contingent valuation questions, in a follow-up question, respondents were requested to provide their judgement with respect to the political consequences of their responses:

> "How likely do you believe that results of surveys, such as the present one, influence policy decisions on the amount of the surcharge for the promotion of renewable energy technologies (EEG Levy)?"

The answers to this question are measured on a 5-point Likert scale, where 1 stands for "Very unlikely" and 5 indicates "Very likely".

Following Vossler and Watson (2013), we assign those respondents who chose the option "Very unlikely" to the inconsequential group, but all others to the consequential group, an assignment reflected by the dummy variable *Consequentiality* presented in Table 2. This assignment is in accordance with economic theory, suggesting a distinction between people who believe that their responses might influence the action of policy makers at least to some extent and those who do not see any link between surveys and policy actions (Carson and Groves, 2007; Vossler et al., 2012).

About 60% of the respondents selected themselves into the consequential group (Table 2). The remaining 40% of the respondents selected themselves into the inconsequential group. This share is rather high compared to the literature, where the share of the inconsequential group ranges from 4% in the study by Herriges et al. (2010) up to 30% in Hwang et al. (2014). This discrepancy, however, may be due to the fact that our survey was conducted in Germany, while most other studies originate from the US.

3 Descriptive Statistics

To compare responses across formats, we follow Balistreri et al. (2001) and convert the WTP bids originating from the open-ended questions into binary values by assuming that respondents would have accepted a randomly given increase in the EEG Levy of either 1, 2, or 4 cents if their WTP bid were to be at least as large as the respective levy increase, thereby randomly allocating the open-ended bids to one of the three levy increases. The resulting binary variable of acceptance serves as the dependent variable in the estimations presented in the subsequent section. The randomized transformation of the continuous WTP bids into 0/1 values is highly important for getting unbiased estimates of the difference between the discrete-choice and open-ended valuation formats (Balistreri et al., 2001),

The panel at the right-hand side of Table 3 reports the results of this exercise, that is, the shares of those respondents who would accept a future increase in the surcharge for the promotion of green electricity (EEG Levy) of either 1, 2, or 4 cents. Not surprisingly, for both formats, a stronger increase in this levy comes with a decrease in the acceptance rates.

From a casual inspection, apart from the strongest increase in the promotion cost of green electricity of 4 cents per kWh, we see substantial differences in the acceptance rates of further cost increases across both formats: Apparently, the mean acceptance rates are much higher for respondents who are faced with open-ended questions. This

Table 3: **Acceptance Rates of a Rise in the Promotion Cost of Renewable Technologies across Elicitation Formats**

	Discrete-Choice Format		Open-Ended Format		
	Number of Observations	Share of Yes Responses	Number of Observations	Share of Yes Responses	t Statistics
1 Cent	1,086	53.6%	951	70.5%	-7.93***
2 Cents	1,062	46.3%	978	57.4%	-5.01***
4 Cents	1,064	33.7%	951	33.7%	0.03
Total	3,212	44.6%	2,880	53.9%	-7.26***

Note: * denotes significance at the 5 %-level, ** at the 1 %-level, and *** at the 0.1 %-level, respectively.

impression can be confirmed using a t test:

$$t = \frac{\overline{x}_{DC} - \overline{x}_{OE}}{s_p * \sqrt{\frac{1}{n_{DC}} + \frac{1}{n_{OE}}}}, \tag{1}$$

where $\overline{x}_{DC}$ and $\overline{x}_{OE}$ denote the mean acceptance rates of the discrete-choice and open-ended valuation groups, respectively, n_{DC} and n_{OE} the respective sample sizes, and s_p is the pooled standard deviation of the acceptance rates of the two subgroups. The resulting t statistics, reported in the last column of Table 3, indicate that the difference between both formats is statistically significantly different from 0 for levy increases of 1 and 2 cents, but not for an increase of 4 cents.

With respect to the impact of the consequential script, we find no statistically significant differences between respondents who received the consequential script and those who did not. This is indicated by the t statistics reported in Table 4, which are calculated along the lines of Equation 1. In contrast to the consequential script, there are dramatic discrepancies across the consequential and inconsequential groups (Table 5): For both the discrete-choice and the open-ended format, the acceptance rates are significantly higher for respondents who believe that their responses might influence the action of policy makers. This finding is supported by the open-ended bids: with 1 cent, the median bid for the inconsequential group is lower than the median of 3 cents for the consequential group.

Table 4: **Acceptance Rates of the Promotion Cost of Renewable Technologies when Elicitation Formats are Crossed with the Consequential Script**

	Discrete-Choice Format					Open-Ended Format				
Consequential Script	No		Yes			No		Yes		
	# of Obs.	Share of Yes	# of Obs.	Share of Yes	t Statistics	# of Obs.	Share of Yes	# of Obs.	Share of Yes	t Statistics
1 Cent	552	53.8%	534	53.4%	0.14	465	70.1%	487	70.8%	-0.25
2 Cents	525	47.1%	537	45.6%	0.46	479	57.6%	499	57.1%	0.16
4 Cents	528	34.1%	536	33.4%	0.24	457	31.3%	493	35.9%	-1.50
Total	1,605	45.1%	1,607	44.1%	0.56	1,401	53.2%	1,479	54.6%	-0.75

Note: * denotes significance at the 5 %-level, ** at the 1 %-level, and *** at the 0.1 %-level, respectively.

Table 5: **Acceptance Rates of the Promotion Cost of Renewable Technologies when Elicitation Formats are Crossed with Consequentiality**

	Discrete-Choice Format					Open-Ended Format				
Consequentiality	No		Yes			No		Yes		
	# of Obs.	Share of Yes	# of Obs.	Share of Yes	t Statistics	# of Obs.	Share of Yes	# of Obs.	Share of Yes	t Statistics
1 Cent	406	32.0%	666	66.5%	11.65***	380	53.2%	561	81.8%	9.91***
2 Cents	398	21.6%	651	61.4%	13.61***	380	42.9%	592	66.6%	7.48***
4 Cents	446	13.0%	603	49.3%	13.24***	391	23.0%	552	41.1%	5.90***
Total	1,250	21.9%	1,920	59.4%	22.29***	1,151	39.5%	1,705	63.3%	12.87***

Note: * denotes significance at the 5 %-level, ** at the 1 %-level, and *** at the 0.1 %-level, respectively.

4 Methodology

Pooling the observations from the discrete-choice and open-ended formats, we estimate both a probit and a linear probability model that are based on the following spec-

ification: [4]

$$\begin{aligned} Yes_i &= \beta_0 + \beta_1 Discrete\text{-}Choice_i + \beta_2\, 2\, Cents_i + \beta_3\, 4\, Cents_i + \beta_4\, Script_i \\ &\quad + \beta_5 Consequentiality_i + \beta_6 (Consequentiality_i * Discrete\text{-}Choice_i) \\ &\quad + \boldsymbol{\delta}^T \mathbf{x}_i + \epsilon_i, \end{aligned} \tag{2}$$

where Yes_i is a dummy variable that equals unity if individual i accepts a given increase in the EEG Levy and zero otherwise, 2 *Cents* and 4 *Cents* are dummy variables that indicate whether this increase amounts to 2 or 4 cents, respectively, with 1 cent as the base category. $Discrete\text{-}Choice_i$ is a dummy variable that tells us whether respondent i received the corresponding question in the discrete-choice format. The dummy variable (*Script*) indicates whether the respondent received a consequential script. Most importantly, Equation 2 also includes the dummy variable *Consequentiality*, which reflects respondents' belief that their responses may have political consequences. To investigate whether political consequentiality affects responses differently depending on the elicitation format, an interaction term is added to Equation 2. The specification is completed with a vector $\mathbf{x}$ of socio-economic characteristics, such as gender, age, and education of the household head, household size and income, and whether there are children in the household, while $\boldsymbol{\delta}$ is the corresponding parameter vector and ϵ designates an idiosyncratic error term.

To cope with the potential endogeneity of consequentiality, we apply an endogenous switching regression model (see Maddala, 1983, pp. 223-228) that, in the first stage, divides respondents into two regimes, those who believe that their responses may have political consequences to at least some extent and those who do not:

$$\begin{aligned} Consequentiality_i &= 1 \qquad \text{if } \boldsymbol{\gamma}^T \cdot \mathbf{z}_i \geq u_i, \\ Consequentiality_i &= 0 \qquad \text{otherwise,} \end{aligned} \tag{3}$$

where vector $\mathbf{z}_i$ includes factors that may affect whether a household head i either believes that her answer influences the political decision making ($Consequentiality_i = 1$)

[4] Angrist and Pischke (2009) recommend estimating linear probability models instead of nonlinear models to avoid distributional assumptions. To check the robustness of our results, we also estimate specification 2 using a probit model.

or the respondent believes this to be very unlikely ($Consequentiality_i = 0$). The unknown parameter vector γ that determines the consequentiality status can be estimated – up to a scale factor – using standard probit maximum likelihood methods, where, due to the indeterminacy of the scale factor, $Var(u_i) = 1$ can be assumed.

Depending on consequentiality status, the second-stage equations of this endogenous switching regression model are given by:

$$WTP_{1i} = \boldsymbol{\beta}_1^T \cdot \mathbf{x}_{1i} - \sigma_{1u} \cdot \text{IVM}_{1i} + \varepsilon_{1i}, \text{ if } Consequentiality_i = 1, \tag{4}$$

$$WTP_{0i} = \boldsymbol{\beta}_0^T \cdot \mathbf{x}_{0i} + \sigma_{0u} \cdot \text{IVM}_{0i} + \varepsilon_{0i}, \text{ if } Consequentiality_i = 0, \tag{5}$$

where ε_{1i} and ε_{0i} are residuals with zero conditional mean, WTP_{1i} and WTP_{0i} denote the household heads' individual WTP bids and $\mathbf{x}_{1i}$ and $\mathbf{x}_{0i}$ include their determinants, such as net household income, while $\boldsymbol{\beta}_1$ and $\boldsymbol{\beta}_0$ are vectors of the associated parameters to be estimated. The two variables

$$\text{IVM}_{1i} := \frac{\phi(\boldsymbol{\gamma}^T \cdot \mathbf{z}_i)}{\Phi(\boldsymbol{\gamma}^T \cdot \mathbf{z}_i)}, \qquad \text{IVM}_{0i} := \frac{\phi(\boldsymbol{\gamma}^T \cdot \mathbf{z}_i)}{1 - \Phi(\boldsymbol{\gamma}^T \cdot \mathbf{z}_i)} \tag{6}$$

represent variants of the inverse Mills ratios, with $\phi(.)$ and $\Phi(.)$ denoting the density and cumulative density function of the standard normal distribution, respectively. When appended as extra regressors in the second-stage estimation, the inverse Mills ratios are controls for potential biases arising from sample selectivity: It is likely that unobservable factors, such as carelessness about electricity bills, also affect WTP bids. If the estimates of the coefficients σ_{1u} and σ_{0u} are statistically significant, this is an indication of sample selectivity.

For the second-stage estimation, we insert the predicted values $\widehat{\text{IVM}}_{1i}$ and $\widehat{\text{IVM}}_{0i}$ using the probit estimates $\widehat{\gamma}$ of the first-stage estimation. Given that the variance of the residuals is heteroscedastic in nature (see Maddala, 1983, p. 225), Equations 4 and 5 should be estimated by weighted least squares using the Huber-White estimates of variance. In addition to employing this two-stage procedure, we estimate both stages at once using full information maximum likelihood (FIML) methods and the Stata command movestay (Lokshin and Sajaia, 2004) to check the robustness of the results and obtain consistent estimates of the standard errors.

Identification of the switching regression model requires specifying at least one variable that determines the discrete first-stage outcome on consequentiality, but does not affect the WTP response described by the second-stage model (exclusion restriction). To this end, we employ a dummy variable that equals unity if a respondent needed more time to finish the survey than the median duration of 22.55 minutes and zero otherwise (*more time*, see Table 2). Assuming that this variable is uncorrelated with an individual's WTP, it is not included in the second-stage regression.

5 Results

Estimating specification 2 using a linear probability model (LPM) reconfirms the descriptive findings presented in Section 3: In contrast to the majority of empirical analyses, our WTP bids resulting from the discrete-choice questions tend to be lower than those originating from the open-ended format (Table 6). In fact, our results contrast most with those of Seller et al. (1985), who elicit WTP estimates from the discrete-choice format that are up to four times as large as those originating from the open-ended format. Other studies, such as Kealy and Turner (1993) and Halvorsen and Sœlensminde (1998), find the discrete-choice estimates about twice as large as those of the open-ended format. Compared to these studies, the difference of less than 20 percentage points between our open-ended and discrete-choice estimates is rather moderate, but significant in statistical and economic terms.

Furthermore, in line with theory, strong increases in the EEG Levy have a negative effect on the acceptance of this additional burden for German households, with the effect being most pronounced in case of a 4-cents increase. Of the socio-economic characteristics, higher age, being female and having a college education are associated with higher WTP values, while having children moderates the WTP for green electricity. Income and household size do not have any effect on WTP, nor does the reception of a consequential script.

The marginal effects resulting from the corresponding probit model estimation,

presented at the right-hand panel of Table 6, mimic the coefficient estimates of the LPM in terms of signs, magnitudes, and significance levels. Most notably, we again find a positive relationship between WTP and political consequentiality, which is associated with a higher WTP of approximately 20 percentage points. This outcome is in line with the studies by Herriges et al. (2010), Hwang et al. (2014), Vossler and Watson (2013) and Vossler and Holladay (2016), who also find a higher WTP for the consequential group. Another result also bears noting: the positive coefficient on the interaction term *Consequentiality * Discrete-Choice* indicates that the difference between open-ended and discrete-choice contingent valuation is reduced, to less than 6 percentage points when focusing on those individuals who perceive their answer as politically consequential.

Table 6: **Estimation Results for the Acceptance of Future Rises in the Promotion Cost of Green Electricity**

	Linear Probability Model		Probit Coefficients		Probit Marginal Effects	
Discrete-Choice	-0.193***	(0.021)	-0.600***	(0.065)	-0.206***	(0.022)
2 Cents	-0.107***	(0.016)	-0.303***	(0.047)	-0.104***	(0.016)
4 Cents	-0.274***	(0.016)	-0.784***	(0.048)	-0.269***	(0.015)
Script	-0.011	(0.013)	-0.033	(0.039)	-0.011	(0.013)
Consequentiality	0.214***	(0.021)	0.581***	(0.057)	0.199***	(0.019)
Consequentiality * Discrete-Choice	0.135***	(0.027)	0.434***	(0.081)	0.149***	(0.028)
Female	0.078***	(0.015)	0.226***	(0.043)	0.077***	(0.015)
Children	-0.054**	(0.018)	-0.162**	(0.053)	-0.055**	(0.018)
Age	0.002**	(0.001)	0.006**	(0.002)	0.002**	(0.001)
College Degree	0.060***	(0.015)	0.169***	(0.044)	0.058***	(0.015)
High income	0.007	(0.020)	0.013	(0.058)	0.005	(0.020)
Medium income	-0.026	(0.021)	-0.087	(0.062)	-0.030	(0.021)
Low income	-0.039	(0.034)	-0.122	(0.098)	-0.042	(0.033)
1-Person household	0.004	(0.028)	0.008	(0.083)	0.003	(0.028)
2-Person household	-0.046	(0.024)	-0.140*	(0.071)	-0.048*	(0.024)
3-Person household	-0.039	(0.027)	-0.116	(0.078)	-0.040	(0.027)
Constant	0.467***	(0.039)	-0.071	(0.113)	–	–
Number of Observations:	4,713		4,713		4,713	

Note: Standard errors are in parentheses, * denotes significance at the 5 %-level, ** at the 1 %-level, and *** at the 0.1 %-level, respectively.

To address potential sample selectivity problems, we additionally estimate the

endogenous switching regression model. Using the two-step approach described in the methodology section, the first-stage results indicate that consequentiality is strongly correlated with the indicator that a respondent needs more time to complete the questionnaire than the median duration (Table 7). The coefficient estimates of the second-stage regression reconfirm the estimation results obtained from the LPM and probit model. Specifically, from the coefficient estimate on the discrete-choice dummy in the second-stage regression, we see again that the difference between both validation formats shrinks to about 6 percentage points if we only take into account people who perceive their answer as politically consequential. One possible reason for the similarity of the results of the switching regression model and those presented in Table 6 is the absence of sample selectivity as indicated by the statistically insignificant coefficients on the inverse Mills ratio.

It is also of note that the results of the full information maximum likelihood estimation, displayed in Table A2 of the Appendix, are very similar to those presented in Table 7. Finally, the conjecture of no sample selectivity that is derived from the switching regression model is also supported by the estimates reported in Table A3 of the Appendix, where the results of two separate regressions are presented: one for those respondents who do believe that surveys influence the political decision making and one for those who do not. In fact, the results of Table 7 and A3 are virtually identical.

6 Summary and Conclusions

Based on hypothetical responses originating from a large survey among more than 7,000 German households on their willingness-to-pay (WTP) for green electricity, this paper has provided further evidence on the discrepancy between the outcomes of discrete-choice and open-ended contingent valuation methods, thereby accounting for perceived consequentiality for policy making. Theoretical work suggests that simple survey-based assessments of consequentiality are integral to the analysis of stated-preference data (Vossler and Watson, 2013). Recognizing that a respondent's conse-

Table 7: **Two-Step Estimation Results for the Endogenous Switching Regression Model**

	First Stage		Second Stage			
			Consequentiality = 0		Consequentiality = 1	
Discrete-Choice	0.028	(0.038)	-0.194***	(0.021)	-0.058***	(0.018)
2 Cents	0.008	(0.046)	-0.089***	(0.027)	-0.117***	(0.021)
4 Cents	-0.054	(0.046)	-0.234***	(0.026)	-0.300***	(0.022)
Script	0.081*	(0.037)	-0.029	(0.023)	0.002	(0.020)
Female	0.115**	(0.042)	0.109***	(0.028)	0.061**	(0.023)
Children	-0.073	(0.052)	-0.053	(0.030)	-0.058*	(0.025)
Age	-0.000	(0.002)	0.002	(0.001)	0.002**	(0.001)
College Degree	0.300***	(0.043)	0.040	(0.046)	0.075*	(0.038)
High income	0.065	(0.056)	-0.013	(0.033)	0.019	(0.027)
Medium income	-0.074	(0.059)	-0.063	(0.035)	-0.003	(0.029)
Low income	-0.184*	(0.093)	-0.034	(0.056)	-0.048	(0.050)
1-Person household	0.148	(0.081)	-0.014	(0.046)	0.015	(0.042)
2-Person household	0.055	(0.068)	-0.050	(0.037)	-0.045	(0.033)
3-Person household	0.197**	(0.075)	-0.032	(0.047)	-0.041	(0.043)
More time	0.162***	(0.039)	–	–	–	–
IVM0	–	–	-0.017	(0.190)	–	–
IVM1	–	–	–	–	0.015	(0.203)
Constant	0.029	(0.105)	0.518**	(0.167)	0.645***	(0.163)
Number of Observations:	4,713		1,812		2,901	

Note: Standard errors are in parentheses, * denotes significance at the 5 %-level, ** at the 1 %-level, and *** at the 0.1 %-level, respectively.

quentiality status and WTP might be jointly influenced by unobservable factors, a distinguishing feature of our study is the estimation of a switching regression model that accounts for the potential endogeneity of respondents' belief in political consequences. The results of this exercise, though, indicate the absence of sample selectivity.

Consistent with Czajkowski et al. (2015), Herriges et al. (2010), Hwang et al. (2014), Nepal et al. (2009), Vossler and Watson (2013), and Vossler and Holladay (2016), we find a positive relationship between consequentiality and WTP, a result that Vossler and Watson (2013) call negative hypothetical bias: those respondents who perceive there to be policy consequences exhibit a WTP that, on average, is approximately 20

percentage points higher than those who do not. Thus, we provide for further evidence that may reverse the common perception that stated-preference methods overestimate non-market values.

While these findings have profound implications for the interpretation of the results of former stated-preference studies (Vossler and Watson, 2013), two other key results emerge from our empirical analysis. First, the WTP values resulting from the open-ended method are generally higher than those originating from the discrete-choice format. Interestingly, this outcome was expected by most economists, but former empirical analyses, such as Halvorsen and Sœlensminde (1998), Kealy and Turner (1993), and Seller et al. (1985), obtained the opposite result that WTP estimates originating from the discrete-choice format are substantially larger than those from the open-ended format.

Inspired by this contrast, Carson and Groves (2007) theoretically discuss the circumstances under which either outcome can be expected. Notably, large open-ended WTP bids may be the result of strategic considerations and an optimal strategy if an individual's WTP is higher than the potential costs of providing a public good, being in perfect accord with economic theory. In our empirical example of green electricity, large WTP bids may indicate strong preferences for its provision, not least based on green attitudes. In fact, exaggerating WTP bids might be a straightforward strategy to signal support for renewable energy policies (Whitehead and Cherry, 2007).

Second, our empirical results suggest that the discrepancy between both contingent valuation formats is strongly reduced when focussing on those individuals who perceive the survey as politically consequential. Such a shrinking discrepancy is also found in a recent study by Vossler and Holladay (2016) for the comparison of single-binary-choice and the standard open-ended format.

In the end, along the lines of the conditions that are theoretically derived by Vossler and Holladay (2016) to ensure incentive compatibility in the open-ended format, further investigations of why the discrepancy between both elicitation formats can be reduced appear to be a promising avenue for future research. Furthermore,

although our results indicate otherwise, future research on consequentiality should also consider the potential endogeneity of respondents' belief in the consequentiality of their answers for policy making.

7 Appendix

Table A1: **Comparing the Means of the Explanatory Variables Across Treatment Groups**

	Open-Ended	Discrete-Choice Format		
	Format	All	1 Cent	2 Cents	4 Cents
Age	55.21	55.37	55.39	55.57	55.16
Female	0.352	0.329	0.319	0.343	0.326
Children	0.704	0.703	0.704	0.714	0.690
College Degree	0.321	0.312	0.317	0.307	0.312
Script	0.500	0.500	0.499	0.500	0.500
Consequentialiy	0.591	0.608	0.620	0.625	0.579
1 Cent	0.331	0.333	1	0	0
2 Cents	0.340	0.333	0	1	0
4 Cents	0.330	0.333	0	0	1
Low income	0.083	0.082	0.080	0.088	0.078
Medium income	0.412	0.433	0.437	0.428	0.434
High income	0.334	0.313	0.304	0.303	0.331
Very high income	0.169	0.172	0.179	0.181	0.157
1-Person household	0.269	0.275	0.273	0.269	0.282
2-Person household	0.489	0.472	0.486	0.478	0.453
3-Person household	0.132	0.130	0.123	0.125	0.143
>3-Person household	0.109	0.123	0.118	0.128	0.122
More time	0.510	0.494	0.503	0.508	0.470
Number of Observations:	3,517	3,524	1,174	1,175	1,175

Table A2: **Full Information Maximum Likelihood (FIML) Estimation Results for Endogenous Switching Regression Model**

	First Stage		Second Stage			
			Consequentiality = 0		Consequentiality = 1	
Discrete-Choice	0.028	(0.038)	-0.194***	(0.021)	-0.058***	(0.018)
2 Cents	0.008	(0.046)	-0.089***	(0.027)	-0.117***	(0.021)
4 Cents	-0.053	(0.046)	-0.234***	(0.025)	-0.300***	(0.021)
Script	0.081*	(0.037)	-0.030	(0.021)	0.002	(0.018)
Female	0.115**	(0.042)	0.109***	(0.024)	0.060**	(0.020)
Children	-0.073	(0.052)	-0.052	(0.028)	-0.057*	(0.024)
Age	-0.000	(0.002)	0.002	(0.001)	0.002**	(0.001)
College Degree	0.300***	(0.043)	0.038	(0.029)	0.074*	(0.022)
High income	0.065	(0.056)	-0.014	(0.033)	0.018	(0.026)
Medium income	-0.074	(0.059)	-0.063	(0.033)	-0.003	(0.028)
Low income	-0.184*	(0.093)	-0.033	(0.052)	-0.047	(0.046)
1-Person household	0.148	(0.081)	-0.015	(0.042)	0.014	(0.039)
2-Person household	0.055	(0.068)	-0.050	(0.036)	-0.046	(0.032)
3-Person household	0.197**	(0.075)	-0.034	(0.042)	-0.042	(0.037)
More time	0.162***	(0.039)	–	–	–	–
IVM0	–	–	-0.017	(0.170)	–	–
IVM1	–	–	–	–	0.014	(0.165)
Constant	0.029	(0.105)	0.511**	(0.086)	0.651***	(0.077)
Number of Observations:	4,713		1,812		2,901	

Note: Standard Errors are in parentheses, * denotes significance at the 5 %-level, ** at the 1 %-level, and *** at the 0.1 %-level, respectively.

Table A3: **Estimation Results for the Acceptance of Future Rises in the Promotion Cost of Green Electricity differentiated for Believing in Consequentiality**

	Consequentiality = 0		Consequentiality = 1	
Discrete-Choice	-0.194***	(0.021)	-0.058***	(0.018)
2 Cents	-0.089***	(0.027)	-0.117***	(0.021)
4 Cents	-0.234***	(0.025)	-0.300***	(0.021)
Script	-0.030	(0.020)	0.002	(0.018)
Female	0.108***	(0.024)	0.060**	(0.019)
Children	-0.052	(0.028)	-0.057*	(0.024)
Age	0.002	(0.001)	0.002**	(0.001)
College Degree	0.037	(0.026)	0.073***	(0.019)
High income	-0.014	(0.033)	0.018	(0.026)
Medium income	-0.063	(0.033)	-0.003	(0.028)
Low income	-0.032	(0.051)	-0.047	(0.046)
1-Person household	-0.016	(0.042)	0.014	(0.038)
2-Person household	-0.051	(0.036)	-0.046	(0.032)
3-Person household	-0.035	(0.041)	-0.042	(0.035)
Constant	0.505***	(0.059)	0.656***	(0.048)
Number of Observations:	1,812		2,901	

Note: Standard Errors are in parentheses, * denotes significance at the 5 %-level,

** at the 1 %-level, and *** at the 0.1 %-level, respectively.

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