RUHR

ECONOMIC PAPERS

Beyond the Single Binary Choice Format for Eliciting Willingness to Accept: Evidence from a Field Study on Onshore Wind Farms

Valeria Fanghella, Carlo Fezzi, Joachim Schleich, and Carine Sebi

rwi

#1184

Imprint

Ruhr Economic Papers #1184

Responsible Editor: Manuel Frondel
RWI – Leibniz-Institut für Wirtschaftsforschung e.V.
Hohenzollernstraße 1–3 | 45128 Essen, Germany
Fon: +49 201 8149-0 | email: rwi@rwi-essen.de
www.rwi-essen.de

The Institute has the legal form of a registered association;
Vereinsregister, Amtsgericht Essen VR 1784

Published by

RWI – Leibniz-Institut für Wirtschaftsforschung e.V.
Hohenzollernstr. 1-3, 45128 Essen, Germany

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Bergische Universität Wuppertal, Schumpeter School of Business and Economics
Gaußstraße 20, 42119 Wuppertal

RWI is funded by the Federal Government and the federal state of North Rhine-Westphalia.

ISSN 1864-4872 (online)
ISBN 978-3-96973-369-1
DOI https://dx.doi.org/10.4419/96973369

Beyond the single binary choice format for eliciting willingness to accept:

Evidence from a field study on onshore wind farms

Valeria Fanghella, Carlo Fezzi, Joachim Schleich, Carine Sebi*

October 2025

Abstract

This study assesses the incentive compatibility of different elicitation formats for estimating willingness to accept (WTA) in the field. We assess the convergent validity of standard and *theory-driven* (i.e. based on mechanism-design theory) versions of the double-bounded binary choice (DB) and the open-ended (OE) formats against the single-binary choice (SBC). Our empirical application, developed in collaboration with a major energy company, is based on estimating compensation for the installation of wind farms in respondents' municipalities of residence. We find strong evidence against convergent validity for both versions of the OE format. In comparison, both versions of the DB format, especially the theory-driven version, yield WTA estimates similar to those of the SBC, ranging from near zero for supporters of wind power to €1500–€1800 for opponents. Finally, we introduce a novel econometric approach that allows the utility of compensation to be non-linear when estimating WTA (and WTP) from binary choices.

Keywords: contingent valuation; willingness to accept; wind farm; mechanism design.

JEL codes: C10; C93; D60; H41; Q51.

* Valeria Fanghella: EDHEC Business School, France; corresponding author: valeria.fanghella@edhec.edu. Carlo Fezzi: University of Trento, Trento, Italy; carlo.fezzi@unitn.it. Joachim Schleich: Grenoble Ecole de Management, 12 Pierre Sémard, 38000, Grenoble, France and Fraunhofer Institute for Systems and Innovation Research, Breslauer Straße 48, 76139, Karlsruhe, Germany; joachim.schleich@grenoble-em.com. Carine Sebi: Grenoble Ecole de Management, 12 Pierre Sémard, 38000, Grenoble, France; carine.sebi@grenoble-em.com.

1 Introduction

In the past 60 years, stated preference methods have been widely applied to estimate the economic value of non-market goods (Carson, 2012). In empirical studies, it is critical to choose the appropriate elicitation method that yields both valid and informative welfare measures. The single binary choice (SBC) framed as an advisory referendum, has long been regarded as the gold standard of stated preference studies (Arrow et al. 1993; Johnston et al., 2017), because it incentivizes respondents to reveal their true willingness to pay (WTP) for or willingness to accept (WTA) a good or service.

Compared with alternative elicitation formats such as the double-bounded binary choice (DB), open-ended (OE), and payment card (PC), SBC elicits less information from each respondent, and is thus less used in practice. However, these alternative approaches are typically not incentive-compatible and may thus induce individuals to misreport their preferences (Carson et al., 2014; Carson and Groves, 2007; Vossler et al., 2012). In particular, respondents may not perceive the price of the project under scrutiny as uniquely defined and may therefore believe that they can influence how much they would eventually have to pay. Otherwise, respondents may believe that they are voting on a cost that differs from the one proposed, such as the average of the two amounts shown in the DB format (Carson and Groves, 2007). This generates so-called 'elicitation effects' whereby welfare estimates are sensitive to the format employed (e.g., Cameron et al., 2002; Welsh and Poe, 1998).[1]

An emerging body of literature relies on mechanism-design theory to develop and test the conditions under which these alternative formats elicit incentive-compatible WTP measures. Vossler and Zawojska (2020) conduct a laboratory experiment to test the convergent validity of DB, OE, and PC formats by comparing the resulting WTP estimates with those obtained from SBC. By informing respondents that the cost of the project will be determined exogenously after submitting their answers, the authors ensure incentive compatibility for these theory-driven versions of DB, OE, and PC and find convergent validity for all methods.

By the same token, Vossler and Holladay (2018) show that alternative elicitation methods for WTP can also be designed to be incentive-compatible in the field by communicating to respondents that the project's cost is currently uncertain but will become known in the future and depends on

[1] An alternative explanation is that differences across elicitation formats are driven by behavioral factors such as anchoring bias (Bateman et al. 2001). Vossler and Zawojska (2020), however, find statistically indistinguishable WTP estimates when the design ensures incentive compatibility, suggesting that such behavioral tendencies may not be the main source of differences across formats.

factors unrelated to respondents' answers to the contingent valuation. They find convergent validity for such *theory-driven OE*, but not for a similarly *theory-driven PC*, suggesting that successful implementation in the field may depend on the characteristics of a given elicitation format.

On this basis, our study's first contribution lies in examining whether the recently proposed theory-driven approaches to estimating WTP are also valid for eliciting WTA. Because WTA is the appropriate measure when individuals feel or hold property rights over the good that is subject to evaluation (Freeman et al., 2014), it is particularly relevant in contexts where citizens are asked to forgo access to environmental, cultural, or health-related resources to which they perceive entitlement. However, eliciting WTA is generally regarded as more challenging than eliciting WTP, as respondents are believed to be more likely to overstate the amount they would ask rather than the amount they would offer for the same good (Arrow et al., 1993). Yet, WTA-WTP disparities diminish when the elicitation is perceived as consequential, indicating that WTA measures are valid in some conditions (Frondel et al., 2021; Vossler et al., 2023). For these reasons, it is of methodological and policy interest to investigate which elicitation formats provide valid WTA estimates.

This paper tests theory-driven versions of DB and OE for eliciting WTA in the field by comparing them against an incentive-compatible SBC elicitation (Lloyd-Smith and Adamowicz, 2018). We also include standard versions of both formats to assess whether the theoretically refined versions perform better than elicitations that do not account for strategic incentives.

Our findings provide strong evidence against the convergent validity of both versions of OE, as their WTA estimates are much higher than those obtained in SBC, highlighting persistent challenges with incentive compatibility when eliciting welfare measures via OE. For DB, results are more encouraging, both on average and when accounting for heterogeneity in preferences. Overall, our findings indicate that WTA estimates remain comparable in magnitude across the SBC and DB formats, especially those obtained in *theory-driven DB*.

As a second contribution, we propose a novel empirical approach to estimating welfare measures (both WTA and WTP) that allows for non-linear utility in money. Unlike incentivized studies conducted in the laboratory, our field study involves high stakes with compensation amounts reaching up to €15000. In such a setting, the common assumption of constant marginal utility of income (e.g., Howard et al, 2021; Vásquez-Lavín et al, 2021) is likely to be violated and generate biased welfare estimates (Andersen et al., 2008). Accordingly, our data strongly reject the assumption of linear utility and are consistent with diminishing marginal utility of compensation.

Our third contribution is empirical and, to the best of our knowledge, lies in providing the first incentive-compatible estimate of WTA for the installation of a wind farm in an individual's municipality. We conducted a pre-registered contingent valuation in collaboration with a large energy company that—at the time the study was conducted—was considering the installation of several onshore wind farms in France. We sample only households residing in municipalities identified by the energy company as potential sites for the installations. Moreover, respondents were informed that their answers may be used to inform the energy company's siting decisions. The contingent valuation is thus consequential across all elicitation formats, meaning that respondents' answer may affect the implementation of the project (Carson and Groves, 2007). Hedonic studies indicate that wind farms generate local negative externalities (e.g., Dong et al., 2024; Gibbons, 2014), highlighting the role that compensation might play in restoring welfare losses. However, the extent to which compensation influences acceptability remains an open empirical question, as most existing studies rely on hypothetical surveys (e.g., Garcia et al., 2016; Strazzera et al., 2012). In a different setting, Germeshausen et al. (2025) proxy wind farm acceptance in Germany with the share of Green Party votes and find that subsidies increase support.

Our estimates reveal substantial heterogeneity in preferences, driven by respondents' support for the national development of wind power. We classify about one-third of the respondents as protesters, i.e. respondents who reject the installation of a wind farm regardless of the proposed compensation. Amongst the non-protesters, the estimates derived in SBC and *theory-driven DB* suggest that average WTAs are low (below €100) but rise to as much as €1500–€1800 for respondents with strong concerns about wind power.

The remainder of the paper is structured as follows. In Section 2 we describe the contingent valuation and in Section 3 and Section 4 we present, respectively, the sample characteristics and descriptive statistics. In Section 5 we present the econometric approach and in Section 6 we present and discuss the results. Section 7 concludes.

2 Survey

2.1 Background

To meet its energy and climate targets, France aims to increase the share of electricity produced by renewable sources from 22% in 2023 to 33% by 2030,[2] with onshore wind playing a major

[2] https://www.statistiques.developpement-durable.gouv.fr/edition-numerique/chiffres-cles-energies-renouvelables-2024/donnees-cles (last accessed on 22/04/2025).

role. To achieve the 2028 target of approximately 34 GW of total onshore wind power, an annual installation of around 2.5 GW is needed, which corresponds to about 1 GW/year more than the average capacity of wind power installed annually during the preceding decade. To overcome widespread local opposition to wind farms (e.g., Enevoldsen and Sovacool, 2016), policymakers and energy companies have been considering compensating hosting communities. When we designed our survey in Autumn 2022, the French government was discussing the *Acceleration of Renewable Energy Production* (APER) law, which initially provided for financial compensation of residents living near new wind farms (Assemblée Nationale, 2022). The final legislation, however, which was adopted in 2023, no longer included such compensation. Although they are not legally required to do so, some energy companies in France have voluntarily introduced financial compensation. For instance, the energy company *RWE,* in collaboration with the energy provider *Energie d'ici*, offers electricity bill discounts to residents of some municipalities hosting their wind farms.[3]

In comparison, other European countries require operators of new wind farms to provide financial compensation to local residents or municipalities. In Sweden, for example, households living within 1 km of wind turbines are fully compensated for their electricity bills (Lundin, 2024), while, in Germany, several Federal States require operators of new wind power plants to compensate residents of the affected municipalities (Brandenburg, 2019; Saxony, 2024).

2.2 Project description

We designed our contingent valuation in collaboration with a major energy company that operates across France and plans to develop several onshore wind farms in the coming years. In light of ongoing regulatory discussions and concerns over local opposition, the company was considering compensating households in affected municipalities. The sample included only households residing in areas the company had identified as potential hosts of the new wind farms.

Regardless of the elicitation format, all respondents received the same background information, which also included the expected characteristics of the new wind farms. We emphasized the consequentiality of the valuation by informing respondents that the results would be shared with the energy company and that their responses could influence the company's decision to site a wind farm in their municipality. We also informed respondents that the company might

[3]https://fr.rwe.com/nosactions/#:~:text=RWE%2C%20c'est%20jusqu',premiers%20parcs%20%C3%A9oliens%20en%20France.andtext=En%20mars%202023%2C%20RWE%20et,riverains%20de%20ses%20parcs%20%C3%A9oliens (last accessed on 22/04/2025).

voluntarily compensate households in municipalities that host a new wind farm.[4] Such lump-sum compensation would be paid upon completion of the new wind farm. All background information was agreed upon with the energy company, avoiding deception.

We then elicited respondents' WTA. For all formats, elicitation was framed as a vote within an advisory referendum. As detailed in Section 2.3.2 through Section 2.3.4, we modified the wording across elicitation formats only to the extent necessary to preserve the specificity of each format; otherwise, we kept the wording consistent. Following the elicitation, all respondents completed follow-up questions, as presented in Section 2.4.

The pre-registration for the study is available at this link and Supplementary Material, Section 1 presents the complete wording, in original language and translated, of the contingent valuation and of the elicitation formats.

2.3 Elicitation formats

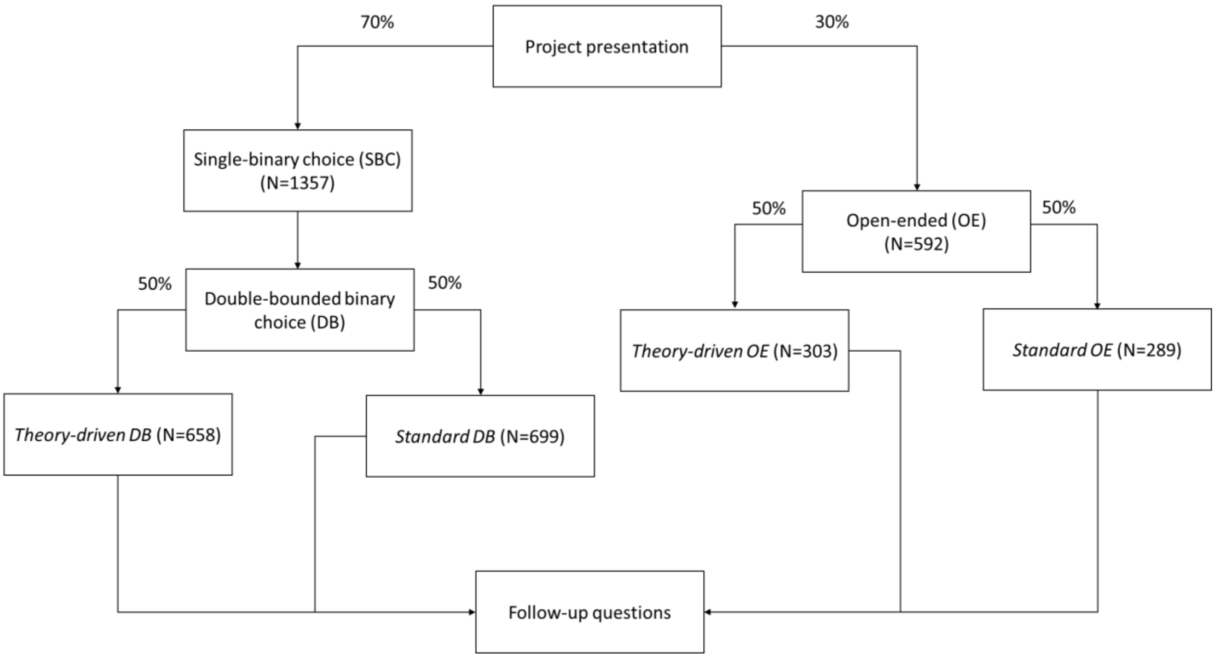
In addition to the incentive-compatible SBC format, taken as the benchmark, we included (i) a DB question which is widely used to improve efficiency over SBC (Carson, 1985; Hanemann et al., 1991) and (ii) an OE question which is also quite common, and, as shown by Vossler and Holladay (2018) and Andor et al. (2021), meets the conditions of incentive-compatibility under certain conditions. Because all elicitation formats were consequential, we were able identify the effects of differences in incentives to respond truthfully across WTA formats. We implemented two versions of the DB and OE formats. The standard versions followed the conventional design in the literature, which typically does not explicitly address strategic behavior. The theory-driven versions incorporated insights from mechanism-design theory to mitigate strategic behavior, as discussed in detail in Section 2.3.1.

To estimate WTA in SBC, we used responses to the first referendum of the DB format. Respondents were not informed in advance of the number of referenda, thereby preserving the incentive compatibility of the first question (Johnston et al., 2017). This approach enabled us to use our sample more efficiently. In our setting, this is especially important given the limited number of respondents who could be recruited from the rural municipalities identified by the energy company as suitable for the installation of wind farms. Respondents were assigned to formats as illustrated in Figure 1. Approximately 70% saw the SBC question and were then split equally

[4] Research finds that the disutility associated with wind farms depends on distance and visual exposure (e.g., Dong et al., 2024). In line with existing measures and policies, we did not vary the compensation amount by these variables.

between *standard DB* and *theory-driven DB*. The remaining respondents were assigned to the OE questions, divided equally between *standard OE* and *theory-driven OE*. This assignment reflects the higher statistical efficiency of the OE format, which yields more information per respondent than the SBC or DB formats.

Figure 1. Survey design



2.3.1 Incentive compatibility

Lloyd-Smith and Adamowicz (2018) show that WTA elicitation is incentive-compatible if: (i) respondents care about the outcome; (ii) the authority can enforce the implementation of the project; (iii) the elicitation involves a yes-or-no vote on a single project; and (iv) the valuation is consequential. That is, respondents envision at least one plausible scenario in which their votes matter in determining the collective outcome of the referendum, given the distribution of others' votes and the rule used to decide whether the referendum passes.

All elicitation formats used in our valuation satisfy conditions (i), (ii), and (iv). The standard versions of the DB and OE formats do not meet condition (iii). When an individual's vote is not tied to a single project, she/he may interpret the contingent valuation as a choice between otherwise identical projects that differ only in the compensation offered. Respondents may therefore believe that their responses can influence the compensation they would receive if the project was implemented, thereby creating an incentive to overstate their WTA to secure higher compensation.

To remove this incentive, we adopted the theory-driven versions of the DB and OE formats. We build on the mechanisms proposed by Vossler and Holladay (2018) and Vossler and Zawojska

(2020) for incentive-compatible WTP elicitation. Drawing on the Becker-DeGroot-Marschak mechanism (Becker et al., 1964) and the random-price voting mechanism (Messer et al., 2010), these studies show that elicitation formats, that feature undetermined monetary attributes, such as DB and OE, can be made incentive-compatible if respondents perceive them as equivalent to answering a series of independent SBC questions. In these referenda, the actual cost is revealed only after respondents submit their choices and is determined independently of their answers, based on external factors such as project costs (Vossler and Holladay, 2018) or computer-based randomization (Vossler and Zawojska, 2020).

In our theory-driven versions of the DB and OE formats, we clarified that the actual compensation amount was to be determined based on factors unrelated to respondents' answers, namely the wind farms' future costs and revenues, which were unknown at the time of the survey. In the *theory-driven OE*, we also informed respondents that their answers would count as 'yes' votes if their asked values were below or equal to the actual compensation amount and as no votes otherwise. This transformed the *theory-driven OE* into a continuum of independent SBC questions. The *theory-driven DB* relies on the same logic but with two amounts only rather than a continuum of amounts.

Finally, in the theory-driven versions, we also clarified how respondents' answers in the contingent valuation would translate into votes once the actual compensation amount was determined. By doing so we mitigated the risk that respondents would adopt alternative interpretations that might undermine incentive compatibility (Carson and Groves, 2007).

In the following sections we describe in detail our elicitation formats and the additional information provided with the theory-driven versions of the DB and OE.

2.3.2 Single binary choice

The SBC format involves a 'yes' or 'no' vote on whether respondent accept having their municipality host the wind farm for a specified compensation amount. Respondents were informed that compensation would be the same for all residents in their municipalities.

The referendum appeared on the screen directly following the project description and was phrased as follows: 'If the energy company paid your household compensation of €X, would you vote in favor of the installation of the wind farm in your municipality?'. Individual compensation varied across respondents and was randomly drawn at equal probabilities from the set {€0, €100, €250, €500, €1000, €2500, €5000, €10000, €15000}.[5]

2.3.3 Double-bounded binary choice

The DB includes two referenda. We used as first referendum the one from the SBC. The second referendum, presented on a subsequent screen, used the exact same wording as the first but with a different compensation amount.

In the *standard DB*, respondents received no additional information beyond what was provided in the project description and the first referendum. As is standard in the field (Haneman et al., 1991), respondents voting 'yes' in the first referendum were offered lower compensation in the second referendum, while those voting 'no' were offered higher compensation. Compensation amounts for the second referendum were randomly drawn from the same set used in the SBC, ensuring comparability across the two elicitation formats.[6] We did not offer a second referendum to respondents who voted 'yes' in the first referendum for compensation of €0, as we did not include any negative compensation amounts.[7]

In the *theory-driven DB*, we informed respondents before the second referendum that, 'due to uncertainties related to the future costs and revenues generated by the wind farm, the final budget available for compensation is still unknown'. Once these costs and revenues become known, respondents' votes, together with those of other residents of their municipality, would be compared with the actual compensation to assess the level of support in that municipality.

2.3.4 Open-ended format

In the OE format, respondents were asked to state the minimum compensation they would require to vote in favor of having wind farms installed in their municipalities. In the *standard OE*, respondents received no additional information beyond what was provided in the project description. The referendum was presented on the screen directly following the project description and read as follows: 'What is the minimum amount of compensation the energy

[5] We determined the compensation amounts from a pilot test using an OE question in an online survey with 154 respondents in France, who are not included in the main study.

[6] The only exception is that DB included €20000 as the maximum amount. To enhance comparability between the SBC and DB elicitation formats, however, we excluded the second choice for respondents who saw €20000 from our main analysis. In Section 6.5, we show that the results do not change if we also include the response to the €20000 option in the estimation of WTA from the DB.

[7] As specified in the pre-registration, these respondents were randomly assigned to either *standard DB* or *theory-driven DB*, even if they did not see a second referendum. Section 6.5 shows that the way these respondents are assigned to versions of DB does not affect the results.

company would have to pay you to get you to vote in favor of the installation of the wind farm in your municipality?'. The *theory-driven OE* included information which was similar to the information provided in *theory-driven DB*. Respondents were also informed that the compensation would be the same for all residents of their municipalities.

2.4 Follow-up questions

After the contingent valuation, respondents were asked to answer questions aimed at identifying protest responses and assessing consequentiality beliefs.

Protesters ask for infinite or disproportionally large compensation as a means of rejecting the idea of trading public goods for money, signaling that they are unwilling to engage in the trade-off proposed in the contingent valuation (Rowe et al., 1980). The challenge in the WTA context lies in distinguishing protest responses from "high takers", i.e. respondents whose asks are high but remain within defined bounds (Ferreira and Gallagher, 2010; Villanueva et al., 2017).

In the DB format, we identified protest responses by including a follow-up question asking respondents to report the reason for their negative votes to both referenda, selecting from (i) 'The level of compensation is too low'; (ii) 'I do not want a wind farm installed in my municipality, regardless of the level of compensation'; (iii) 'I do not care'. Respondents selecting option (ii) were classified as protest responses. Option (iii) was included to identify respondents who are indifferent to the proposed project, i.e. those for whom the wind farm has no impact on utility. In the OE format, respondents could directly express opposition by selecting 'I do not want a wind farm installed in my municipality, regardless of the level of compensation'.

Next, we measured respondents' beliefs about policy and payment consequentiality, adapting the questions used in WTP studies (e.g., Zawojska et al., 2019). Policy consequentiality was measured by asking 'To what extent do you think the results of the advisory referendum will affect the energy company's decision to site a new wind farm in your municipality?'. To elicit payment consequentiality, we asked: 'If the energy company proceeds with its project to install a wind farm in your municipality, do you think it will pay you financial compensation?'.

Finally, we collected information about respondents' socio-demographic characteristics and preferences regarding the development of wind power in France. In this section of the survey, we also included two attention checks to identify participants who were not paying attention. Those failing at least one attention check were screened out, as specified in the pre-registration.

3 Sample characteristics

We collected data through an online survey conducted in France in October 2024, using the existing household panel of the market-research company Dynata. The eligible municipalities for wind power development are small and rural and are underrepresented in panels of market research institutes. To avoid further restricting the sample size, we decided not to impose additional quota criteria.

All participants received a participation fee of about €5 for completing the survey. A total of 3357 individuals were contacted, of whom 1949 completed the survey (we removed 384 respondents who were not living in an eligible municipality, 549 who do not finish the survey, and 475 who failed one of the two attention checks). As documented in Supplementary Table S1, we find no evidence that the elicitation format affects the probability that respondents fail the attention checks. The median and mean survey completion times are 12 minutes and 14 minutes, respectively.

The descriptive statistics, reported in Table 1, indicate that our sample is slightly older and wealthier than the adult population in France and includes slightly lower shares of women and individuals with graduate degrees.

Table 1. Descriptive statistics for the sample and the population in France

	Sample	Population
Female (%)	46	52
Age (median)	56	52
Income (%)		
lower than 2000 €/month	30	40
between 2001 and 3999 €/month	51	40
higher than 4000 €/month	19	20
Graduate degree (%)	18	23

Note: The national distributions of gender and age refer to the population above 18 years of age. Source: Eurostat, 2020. The national distribution of income refers to the entire population. Source: INSEE, 2017. The share of the population with graduate degrees (equivalent of at least BAC + 3) comprise individuals at least 25 years of age. Source: INSEE, 2022.

Prior to our econometric analysis we prepared the data as specified in the pre-registration. First, we removed 603 protest responses. Protest responses are typically excluded (e.g., Ferreira and Gallagher, 2010; Villanueva et al., 2017) because keeping them may distort welfare estimates for those in the market. Moreover, these respondents do not align with the assumptions underpinning our behavioral model (illustrated in Section 5) and, therefore, cannot be used for parameter estimation. In the *standard DB* and *theory-driven DB* formats, 23% and 27% of respondents, respectively, are classified as protests; in the *standard OE* and *theory-driven OE* formats their shares amount to 45% and 44%, respectively. Figure S1 shows that the probability of a protest response is independent of the amount offered in SBC. Therefore, in the binary choice format, the amount offered does not appear to affect the probability of a protest response.

As additional steps of data preparation, in the DB format we also excluded the 22 respondents who indicated being indifferent to the proposed project in the follow-up question, because they violated condition (i) of incentive compatibility. Finally, from the OE format we excluded respondents who indicated extremely high WTA, specifically, above €75000 (10 respondents in *standard OE* and 12 in the *theory-driven OE*). Although we did not pre-register the removal of high asks from OE, we decided to remove these cases because such high amounts likely signaled respondents' refusal to engage in the trade-offs presented in the contingent valuation. These respondents were, presumably, aware that such compensation was not credible for a company to offer and their behavior, like that of the protesters, seemed inconsistent with the assumptions that underpin our behavioral model. We show in Section 6.5 that our conclusions are not affected by alternative coding of extreme WTA values.

The final sample used for our main analyses included 1302 respondents. Details of randomization checks for the full sample and the final sample are reported in Table S2 and Table S3, respectively. Randomization was generally successful in both samples. The only variable that is slightly unbalanced in the final sample (at the 10% significance level, but not at the 5% level) is preference for wind power. Because our analyses account for heterogeneity in WTA based on preferences for wind power, our comparisons across elicitation formats are not confounded by variations in this variable.

4 Descriptive statistics

Table 2 shows the proportion of 'yes' votes per compensation amount by elicitation format in our final sample. The distribution of 'yes' votes is much more similar between SBC and DB than between either of those formats and OE.[8] For no compensation, the proportion of 'yes' votes ranges from 41% in SBC to 52% in DB to 7% in OE. Thus, the findings for SBC and DB (but not for OE) indicate that a large portion of respondents would accept a wind farm in their municipality without requiring compensation. For all elicitation formats, the percentage of 'yes' votes increases at a decreasing rate with the compensation amount, reaching very high levels of acceptance for the highest compensation amount.

[8] For OE, the proportion of 'yes' votes is calculated using the stated WTA as the threshold for the minimum amount that a respondent would be willing to accept.

The distribution of WTA elicited via OE is highly right-skewed, even after removing asks above €75000. The mean WTA is €5118 for the *standard OE* and €5501 for the *theory-driven OE*, while the median is €1000 for both versions of the OE. Additional details are provided in Figure S2.

Table 2. Percentage of 'yes' votes by compensation amount and elicitation format

Amount (€)	*SBC*	*Standard DB*	*Theory-driven DB*	*Standard OE*	*Theory-driven OE*
0	41.5	52.2	52.1	7.33	8.23
100	70.8	59.2	57.8	19.3	22.8
250	76.8	65.3	66	24.7	29.7
500	74.3	69.5	66.4	40	41.1
1000	81.8	64.9	79.8	56	54.4
2500	87.8	79.8	80.8	65.3	63.9
5000	85.7	82.6	81.1	78.7	80.4
10000	93.4	92.9	85.4	88.7	90.5
15000	93.2	85.6	96.8	91.3	91.1

Finally, Table 3 reports the distribution of respondents' beliefs about policy consequentiality (the top half) and payment consequentiality (the bottom half) across elicitation formats. Both policy and payment consequentiality appear to be high, with only about 13% to 17% of respondents believing that the survey would have 'no effect' on the company's decision and about 15% to 23% believing that the company would not provide them with financial compensation should the wind farm be sited in their municipalities. These findings align with those from consequential contingent valuations conducted in the field (Vossler and Holladay, 2018; Vossler et al., 2023).

Based on the p-values reported in the last column of Table 3, we find no evidence that policy consequentiality beliefs differ across elicitation formats. Beliefs in payment consequentiality differ at the 10% level only. This difference is driven by the lower payment consequentiality in the *standard DB* than in the *theory-driven DB* (χ^2 test of independence, p-value = 0.007). This result suggests that the theory-based refinements incorporated into the *theory-driven DB* strengthen respondents' beliefs that the company would pay them compensation should the wind farm be sited in their municipalities.

Table 3. Policy and payment consequentiality by elicitation format

	DB		*OE*		
	Standard	*Theory-driven*	*Standard*	*Theory-driven*	P-value
Policy consequentiality					0.635
No effect	16.8	13.0	13.3	14.6	
Minor effect	44.9	47.9	49.3	53.8	
Major effect	31.5	32.8	31.3	26.6	
Decisive	6.9	6.4	6.0	5.1	
Payment consequentiality					0.070
Certainly not	23.1	16.0	15.3	20.3	
Probably not	52.7	51.9	54.7	54.4	
Probably yes	20.8	27.9	24.0	22.2	
Certainly yes	3.4	4.3	6.0	3.2	

Note: Columns display the percentages of responses to each follow-up question by elicitation format. P-values corresponds to a χ^2 test of independence across all elicitation formats.

5 Econometric modelling

Individuals are assumed to maximize the indirect utility function:

(1) $U(y, \boldsymbol{x}, q, \mathrm{e})$,

where, y is income, $\boldsymbol{x}$ is a vector of individual characteristics, q is the quantity of a public good provided, and e is a stochastic component that is unobservable to the researcher. We begin by illustrating our approach for WTA estimation for SBC and then extend this approach to the other elicitation formats.

5.1 Single binary choice

Individuals compare the utility associated with a) the status quo and b) an alternative scenario which involves accepting the proposed compensation and tolerating any utility losses from a change in the level of the public good, from $q_0$in the status quo to $q_1$in the alternative scenario. In our context, this disutility derives from the installation of the wind farm, such as lower environmental quality, lower property value, and adverse visual or acoustic impacts. Assuming additive separability, these two utilities can be represented as

(2) $U_0 = V_y(y, \boldsymbol{x}) + V_q(q_0, \boldsymbol{x}) + \mathrm{e}_0$, and

(3) $U_1 = V_y(y + c, \boldsymbol{x}) + V_q(q_1, \boldsymbol{x}) + \mathrm{e}_1$,

where c is the compensation offered in the referendum, V_y and V_q represent indirect utility functions, and e_0 and $e_1$are stochastic components unknown to the researcher. The WTA corresponds to the monetary amount that makes individuals indifferent between U_0 and U_1. The standard approach to estimating WTA (Hanemann, 1984) assumes linear utility of income (and of compensation), yielding the following difference in utilities,

(4) $\Delta U = \beta_0 + \beta_1 c + \varepsilon,$

where β_0 represents the average utility loss, $\beta_1$is the marginal utility of income, and ε is the difference between e_0 and e_1. To account for heterogeneity in preferences, β_0 and $\beta_1$can be specified as functions of individual characteristics and the elicitation format. Respondents vote 'yes' to the referendum if this change in utility is positive and 'no' otherwise. The WTA is calculated by setting $\Delta U = 0$ and solving by c. For equation (4), this yields $WTA = -\beta_0/\beta_1$.

To relax the assumption of linear utility of income, we follow the literature that models behavior under risk (e.g., Harrison, List, et al. 2007; Holt and Laury, 2002; Fezzi et al., 2021) and set as the reference point (Kahneman and Tversky, 1979) the utility in the status quo. The change in utility can then be written as

(5) $\Delta U = \beta_0 + f(c) + \varepsilon,$

where $f(.)$ is a generic functional form of the compensation, which can depend on respondents' characteristics.

We consider two alternative specifications for $f(.)$. The first specification involves a reduced-form approach in which each amount in our contingent valuation is represented by a dummy variable. Equation (5) then becomes

(6) $\Delta U = \beta_0 + \sum_{j=1}^{8} \beta_j \, d_j + \varepsilon,$

where d_j are dummy variables identifying each level of compensation and β_j are the corresponding levels of utility, with the utility of no compensation set to zero as the reference point. This functional form offers flexibility in modelling the utility associated with each compensation level. For WTA estimation, we interpolate the estimated β_j linearly and obtain the empirical estimate $\hat{f}(.)$. The WTA is then given by the value of compensation that satisfies $\hat{f}(.) = -\beta_0$.

In the second specification, we use a structural model and specify the utility of the compensation as a power function. The power function is arguably the most widely applied parametric form of a non-linear utility function (Barseghyan et al., 2013; Conte et al., 2011; Fezzi et al., 2021), implies constant relative risk aversion, and accommodates both decreasing and increasing marginal utility. Equation (5) then becomes

$$(7)\ \Delta U = \beta_0 + c^{1-\rho} + \varepsilon\,,$$

where ρ can be interpreted as the coefficient of relative risk aversion, and the special case of linear utility is obtained when $\rho = 0$. WTA is defined as

$$(8)\ \mathrm{WTA} = (-\beta_0)^{\frac{1}{1-\rho}}\,.$$

We estimate all specifications assuming $\varepsilon \sim N(0, \sigma^2)$, leading to binary Probit models. The probability of voting 'yes' to the referendum is then

$$(9)\ p(y = 1) = \Phi([\beta_0 + f(c)]/\sigma)\,,$$

where Φ is the cumulative normal density function. We estimate equation (9) with maximum likelihood, substituting the various expressions of $f(.)$ (linear, reduced-form, power function) into the Bernoulli likelihood. To calculate the confidence intervals of WTA estimates, we employ Monte Carlo simulations, using 5000 draws from the asymptotic joint distribution of the parameter estimates.[9]

5.2 Double-bounded binary choice

Data from the DB format provide right-censored, left-censored, or interval-censored information on respondents' WTAs. Let c_{low} and c_{high} denote the low and high compensation amounts presented to a given respondent in the two referenda. The WTA is right-censored when both amounts are rejected, (i.e. $WTA > c_{high}$), left-censored when they are both accepted ($WTA_i \leq c_{low}$), and interval-censored when an individual accepts c_{high} and rejects c_{low}. Assuming the same utility function specification as used in the structural model for SBC data in equation (7), we can calculate the probability that the WTA lies in the three intervals above as

[9] For the bootstrap draws where $\beta_0 > 0$, WTA is not defined. For these draws, we set WTA=0.

$$(10) \qquad P_{high} = P\big(WTA > c_{high}\big) = \Phi\left(\frac{\beta_0 + c_{high}{}^{1-\rho}}{\sigma}\right),$$

$$(11) \qquad P_{low} = P(WTA \leq c_{low}) = 1 - \Phi\left(\frac{\beta_0 + c_{low}{}^{1-\rho}}{\sigma}\right), \text{ and}$$

$$(12) \qquad P_{mid} = P\big(c_{low} < WTA \leq c_{high}\big) = \Phi\left(\frac{\beta_0 + c_{low}{}^{1-\rho}}{\sigma}\right) - \Phi\left(\frac{\beta_0 + c_{high}{}^{1-\rho}}{\sigma}\right).$$

To estimate the parameters, we maximize the resulting log-likelihood,

$$(13) \qquad \ln L = \sum_{i=1}^{N} k_{i,j} \log\left(P_{i,j}\right),$$

where i (1=1, . . ., N) indexes respondents and $k_{i,j}$ is a dummy variable which equals 1 if the WTA of respondent i is in interval j (j=*high*, *low*, *mid*) and 0 otherwise. Again, the parameters β_0, ρ, and σ can be specified as functions of variables to account for heterogeneity in preferences and elicitation effects. We calculate WTAs following equations (10) through (12) and their confidence intervals via Monte Carlo simulations, using 5000 draws from the asymptotic joint distribution of the parameter estimates.

5.3 Open-ended format

The OE format directly elicits the WTA. Accordingly, our econometric specification focuses on whether WTA varies systematically with respondent characteristics and versions of the OE format. Given the non-negative nature of these data, we follow Wooldridge (2010), who recommend using a Quasi-Poisson model because it is robust to misspecification and accommodates positive, non-integer outcomes, allowing for the mean of the distribution to differ from its variance by employing a dispersion parameter ϕ, which is estimated using Pearson residuals. As in the other formats, in this case we allow parameters to vary by preferences and versions of the elicitation format. This model can be written as

$$(14) \qquad \log(\overline{WTA}) = \boldsymbol{Z\theta},$$

where $\overline{WTA}$ is the mean WTA for a respondent, $\boldsymbol{Z}$ is a vector of variables which account for heterogeneity in preferences and elicitation effects, and $\boldsymbol{\theta}$ is the vector of parameters to be estimated. In this specification, we calculate average WTAs by taking the exponentials of the corresponding parameters and calculate the confidence intervals via Monte Carlo simulation, using 5000 draws from the asymptotic joint distribution of the parameter estimates and taking their exponentials.

All our models and analyses are estimated using the R software (R development core team, 2025).

6 Results

6.1 Single binary choice

Table 4 presents the results of six alternative specifications estimated on SBC data. The first three models assess average preferences by a) assuming linear utility of income (equation (4), M1), b) using the reduced-form dummy-variables approach (equation (6), M2), and c) using the structural model that specifies utility of compensation with a power function (equation (7), M3). We then explore the performance of both M2 and M3 when modified to accommodate heterogeneity in WTA (M4, M5). In these models, we focus on respondents' preferences for wind power as the main source of WTA variability, as it captures most of the observed heterogeneity in responses. We distinguish respondents who oppose or strongly oppose (159 respondents; thereafter referred to as *opponents*), support (618; *mild supporters*), or strongly support (217; *strong supporters*) the national development of wind power. Other respondent characteristics (including income) contribute little to explain choices in any elicitation format, as shown in Table S4.

We start by comparing the models that estimate the average WTA across all respondents. The positive and significant intercept in M1 implies that, on average, respondents would be willing to pay to have wind farms installed in their municipalities. We interpret this counterintuitive finding as an artifact driven by the model's attempt to approximate a non-linear relation using a linear form.

M2 presents a negative constant which is of small magnitude and statistically significant at the 10% level only. This coefficient can be interpreted as disutility experienced by the average respondent resulting from the siting of the wind farm in their municipality. The coefficients for the dummy variables are all positive and increase with compensation amounts, but at a decreasing rate, suggesting diminishing marginal utility of compensation, which is consistent with risk aversion. The fit of this model is significantly better than that of M1, and the linearity assumption is strongly rejected by the data (LR test, χ^2= 56.05, DF= 7, p-value< 0.01).

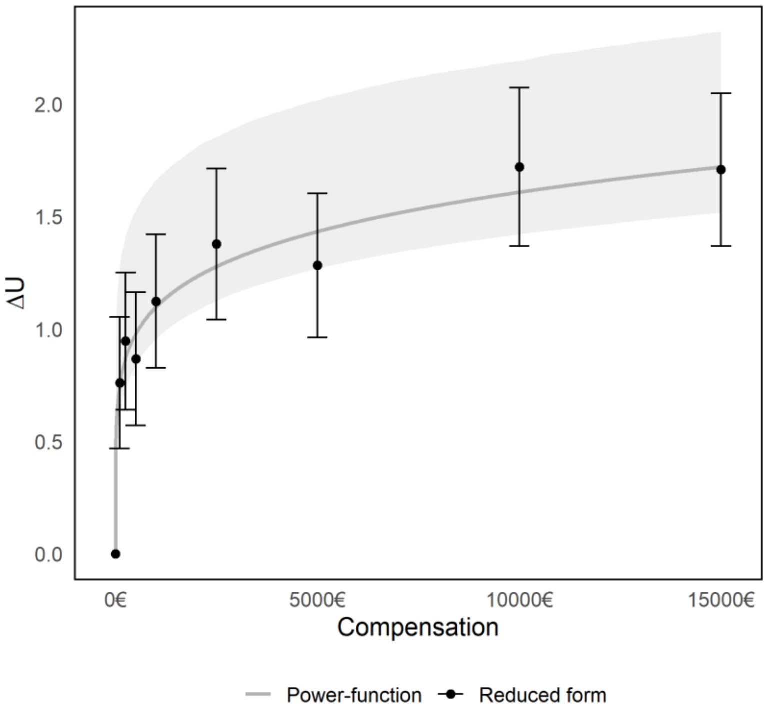
M3 estimates the coefficient of relative risk aversion ρ to be statistically significant and approximately 0.8, indicating diminishing marginal utility of compensation, consistent with risk aversion and of similar magnitude as in previous studies (e.g., Andersen et al., 2008; Fezzi et al., 2021). As in M2, the negative constant reflects the average disutility arising from the siting of the wind farm in a respondent's municipality. We find no significant difference in fit between M3 and M2 (LR test, χ^2= 2.81, DF= 6, p-value= 0.83), suggesting that the power function is well suited to capture respondent behavior. Figure 2 shows the estimated relation between compensation and ΔU estimated using M2 and M3, providing further evidence in favor of this conclusion, as all point estimates of M2 fall within the 90% confidence intervals provided by M3.

Table 4. Estimation results for SBC

	M1 Linear	M2 Reduced form	M3 Power function	M4 Reduced form + heterogeneity in preferences	M5 Power function + heterogeneity in preferences
Constant	0.532***	-0.214*	-0.610**	-1.329***	- 3.739***
	(0.055)	(0.123)	(0.248)	(0.170)	(0.975)
Compensation	0.001***				
	(0.001)				
Compensation: 100		0.761***		0.750***	
		(0.178)		(0.186)	
Compensation: 250		0.946***		1.071***	
		(0.185)		(0.195)	
Compensation: 500		0.867***		0.919***	
		(0.180)		(0.189)	
Compensation: 1000		1.123***		1.267***	
		(0.181)		(0.192)	
Compensation: 2500		1.377***		1.602***	
		(0.204)		(0.222)	
Compensation: 5000		1.282***		1.572***	
		(0.195)		(0.212)	
Compensation: 10000		1.720***		1.966***	
		(0.214)		(0.236)	
Compensation: 15000		1.708***		1.879***	
		(0.207)		(0.223)	
Mild supporter				1.211***	3.393***
				(0.128)	(1.092)
Strong supporter				1.471***	4.09***
				(0.165)	(1.369)
ρ			0.834***		0.82***
			(0.033)		(0.032)
σ			2.869***		2.828**
			(0.932)		(0.874)
Log-Likelihood	-476.796	-448.771	-450.17	-392.657	-394.62

Note: *Mild supporter* is a dummy variable for respondents who moderately support the national development of wind power; *Strong supporter* is a dummy variable for respondents who strongly support the national development of wind power; respondents who oppose or strongly oppose the national development of wind power are used as the baseline. Standard errors are reported in parentheses. * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.

Figure 2. Comparison of reduced-form and power-function models



Note: Points represent coefficients derived from the reduced-form dummy-variables model, with error bars representing 90% confidence intervals (M2, Table 4); the grey line represents predictions derived from the power function model (M3, Table 4), with the shaded grey area representing 90% confidence intervals calculated using Monte Carlo simulations with 5000 draws.

Returning to Table 4, we now consider models that account for WTA heterogeneity by allowing the constant to vary by preferences for wind power. In these models, the constant needs to be interpreted as the disutility of the wind farm installation for opponents of wind power, while the dummy variables represent changes from this baseline for the other two levels of support. In both M4 and M5, all additional parameters are statistically significant, and allowing for heterogeneity in wind preferences significantly improves model fit (LR test M2 vs. M4, χ^2= 112.2, DF= 2, p-value< 0.01; LR test M3 vs. M5, χ^2= 111.1, DF= 2, p-value< 0.01). Again, we find no statistical difference in fit between the structural model and the reduced form model (LR test M4 vs. M5, χ^2= 3.92, DF= 6, p-value= 0.687).

Table 5 reports WTA calculated using the respective models. The estimated average WTA is relatively small with the reduced-form model (approximately €28) and not statistically different from zero with the structural model. Distinguishing WTA by preferences for wind power, we find that the average WTA for opponents is approximately €1300 with M4 and €1500 with M5, while mild supporters have much smaller WTA (about €15 with M4 and zero with M5). For strong supporters, the intercept is not significantly different from zero in both M4 and M5 (p-value=

0.523), which suggest that these respondents would be willing to accept the installation of a wind farm in their municipalities without requiring compensation.

Table 5. WTA estimates for SBC

	Reduced form	Power-function utility
Full sample	28	0.1
	[3; 47]	[0; 1.1]
Opponents	1279	1528
	[771; 2810]	[305; 2840]
Mild supporters	16	0.01
	[0; 17]	[0; 0.4]
Strong supporters	0	0

Note: *Full sample* represents WTA estimates for the full sample; *Opponents* represents WTA estimates for respondents who oppose or strongly oppose the national development of wind power; *Mild supporters* represents WTA estimates for respondents who moderately support the national development of wind power; *Strong supporters* represents WTA estimates for respondents who strongly support the national development of wind power. Shown in parentheses are 90% confidence intervals calculated using Monte Carlo simulations with 5000 draws.

6.2 Double-bounded binary choice

We now consider estimates obtained using the DB data. For this elicitation format, to preserve space, we report only the results obtained with the power-function utility specification. This choice is motivated by the findings reported in the preceding section, which demonstrate that the structural model fits the data as well as the reduced-form approach, but with greater parsimony.

Table 6 presents the results derived from three alternative specifications. In the first column we report estimates of a model which allows the parameters to differ between the *standard DB* and the *theory-driven DB* (M7). We find a moderate degree of risk aversion and a relatively small constant, indicating a modest average WTA. These findings are consistent with those obtained using SBC data. We find no difference between the parameter estimates of the two versions of DB: none of the interaction terms is significant, and a likelihood-ratio test does not reject the null hypothesis that the parameters are equal (χ^2= 3.06, DF= 3, p-value= 0.382).

M8, in the second column, allows the constant to vary by respondents' preferences for wind power. To increase statistical power, we combine data from the *standard DB* and the *theory-driven DB*, since M7 does not show any difference in parameter estimates between the two versions. As before, the constant refers to opponents of wind power while the dummy variables represent changes from this baseline. The estimates align with those obtained using the SBC format. The constant, which reflects the disutility associated with wind farm installation, is statistically significant and negative for opponents, diminishes considerably for supporters, and is not significantly different from zero (p-value= 0.258) for strong supporters. M9 allows for both heterogeneity in preferences and differences between the two versions of DB and confirms the findings derived from M7 and M8.

Table 6. Estimation results for DB

	M7 Heterogeneity in DB version	M8 Heterogeneity in preferences	M9 Heterogeneity in DB version and preferences
Constant	-3.975***	-13.561***	-14.591***
	(0.853)	(2.318)	(2.640)
Theory-driven DB	-0.507		
	(1.301)		
Mild supporter		9.652***	10.865***
		(1.989)	(2.391)
Strong supporter		14.734***	14.775***
		(2.914)	(3.124)
Theory-driven DB x			2.031
Opponent			(1.831)
Theory-driven DB x			-0.404
Mild supporter			(0.955)
Theory-driven DB x			2.542
Strong supporter			(1.894)
ρ	0.676***	0.663***	0.662***
	(0.026)	(0.019)	(0.019)
σ	10.395***	10.019***	10.077***
	(2.570)	(1.795)	(1.807)
Theory-driven DB x ρ	-0.018		
	(0.039)		
Theory-driven DB x σ	0.385		
	(3.873)		
Log-Likelihood	-1,099.75	-1,029.51	-1027.81

Note: All estimates are derived from structural models with power-function utility. *Mild supporter* is a dummy variable for respondents who moderately support the national development of wind power; *strong supporter* is a dummy variable for respondents who strongly support the national development of wind power; respondents who oppose or strongly oppose the national development of wind power are used as the baseline. *Theory-driven DB* is a dummy variable for respondents who are exposed to *theory-driven DB*; *standard DB* is used as the baseline. Standard errors are reported in parentheses. * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.

In Table 6, we report the WTAs obtained from M7, M8, and M9. To formally test whether there are differences in the empirical distributions of WTA between the *standard DB* and the *theory-driven DB*, we apply the complete combinatorial test for independent distributions developed by Poe et al. (2005), using the R package *mded* (Aizaki, 2015).

In line with the results obtained using SBC data, we estimate an average WTA which is relatively low but exhibits significant heterogeneity driven by respondents' preferences for wind power. In both versions of DB, the average WTA ranges between €70 and €80 with confidence intervals ranging from about €30 to €140. Distinguishing by preferences for wind power, for opponents the *theory-driven DB* estimates an average WTA of approximately €1800 while the *standard DB* of about €2800, representing a 55% difference between the two estimates. Considering that SBC estimates a WTA of €1500 for this group, this difference indicates that *theory-driven DB* may be more effective in discouraging strategic behavior among those who oppose wind power. The Poe test finds, however, that the differences between the two formats are not statistically significant and therefore are only speculative at this stage. Regarding mild supporters, average WTA ranges from around €50 to €60, with confidence intervals ranging from about €20 to €130. Finally, for strong supporters we do not calculate WTAs because their constants are not significantly different from zero, indicating that they would not require any compensation to accept the installation of wind farms in their municipalities.

Table 7. WTA estimates for DB

	DB	Standard DB	Theory-driven DB	P-value
Full sample		71	81	0.840
		[25; 133]	[30; 144]	
Opponents	2299	2812	1804	0.280
	[1498; 3044]	[1629; 4024]	[935; 2802]	
Mild supporters	57	49	67	0.684
	[25; 100]	[15; 105]	[24; 136]	
Strong supporters	0	0	0	

Note: *Full sample* represents WTA estimates for the full sample; *Opponents* represents WTA estimates for respondents who oppose or strongly oppose the national development of wind power; *Mild supporters* represents WTA estimates for respondents who moderately support the national development of wind power; *strong supporters* represents WTA estimates for respondents who strongly support the national development of wind power. Shown in parentheses are 90% confidence intervals calculated using Monte Carlo simulations with 5000 draws. P-values are derived from a two-sided complete combinatorial test for independent distributions (Poe et al., 2005) between *standard DB* and *theory-driven DB.*

6.3 Open-ended question

In Table 8, we report the results from estimating a Quasi-Poisson model (equation (14)) via maximum-likelihood methods using the data from the OE format. In the first column, M10 allows preferences to differ between the *standard OE* and the *theory-driven OE*. We find a large, positive, and statistically significant constant, suggesting that individuals exhibit, on average, high WTAs. However, we detect no statistically significant differences between the two versions of the OE format.

M11 accounts for heterogeneity in WTA by preferences for wind power. As in the previous models, the constant refers to opponents of wind power, while the dummy variables represent deviations from this baseline. Consistent with the results obtained in the SBC and DB formats, the negative coefficients for mild supporters and strong supporters indicate that their WTA is lower than the WTA of opponents. For mild supporters, this difference is significant at the 10% level only, while for strong supporters it is statistically significant at the 5% level.

M12 shows significant interactions between preferences for wind power and the two versions of the OE format. In particular, opponents state significantly lower WTA in the *theory-driven OE* format than in the *standard OE* format, whereas the opposite is true for mild supporters.

Table 8. Estimation results for OE

	M10 Heterogeneity in OE version	M11 Heterogeneity in preferences	M12 Heterogeneity in OE version and preferences
Constant	8.540***	9.079***	9.562***
	(0.168)	(0.264)	(0.300)
Theory-driven OE	0.072		
	(0.231)		
Mild supporter		-0.506*	-1.312***
		(0.300)	(0.374)
Strong supporter		-0.828**	-1.052**
		(0.375)	(0.456)
Theory-driven OE x Opponents			-1.111**
			(0.544)
Theory-driven OE x Mild supporter			0.587**
			(0.282)
Theory-driven OE x Strong supporter			-0.505
			(0.510)
ϕ	21754	21330	19243

Note: All estimates are derived from Quasi-Poisson models. *Mild supporter* is a dummy variable for respondents who moderately support the national development of wind power; *strong supporter* is a dummy variable for respondents who firmly support the national development of wind power; respondents who oppose or firmly oppose the national development of wind power are used as the baseline. *Theory-driven OE* is a dummy variable for respondents exposed to *theory-driven OE*; *standard OE* is used as the baseline. The dispersion parameter is indicated as ϕ. Standard errors are reported in parentheses. * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.

Table 9 reports the WTA estimates obtained from M10, M11, and M12. Regarding the first row, we notice that the average WTA is about €5000 for both versions of the OE format and, therefore, much higher than the values estimated in the SBC or DB. The complete combinatorial test for independent distributions confirms the presence of heterogeneity across preferences for wind power and versions of the OE. In particular, the WTA for opponents is higher in the *standard OE* (about €14000, corresponding to almost 10 times the WTA estimated by the SBC) than in the *theory-driven OE*, with a statistically significant difference of almost €10000. On the other hand, the WTA for mild supporters is higher in the *theory-driven OE* than in the *standard OE* by about €3000. Finally, we do not find statistically significant differences among strong supporters. Overall, these results suggest that respondents exhibit strategic behavior in both versions of the OE format, with such behavior only partially mitigated in the theory-driven version.

Table 9. WTA estimates for OE

	OE	Standard OE	Theory-driven OE	P-value
Full sample		5117	5501	0.951
		[3870; 6764]	[4229; 7119]	
Opponents	8767	14217	4680	0.043
	[5683; 13544]	[8634; 23318]	[2238; 9958]	
Mild supporters	5288	3829	6888	0.037
	[4174; 6717]	[2666; 5514]	[5201; 9094]	
Strong supporters	3831	4967	2998	0.324
	[2450; 5938]	[2798; 8661]	[1583; 5569]	

Note: *Full sample* represents WTA estimates for the full sample; *Opponents* represents WTA estimates for respondents who oppose or strongly oppose the national development of wind power; *Mild supporters* represents WTA estimates for respondents who moderately support the national development of wind power; *Strong supporters* represent WTA estimates for respondents who strongly support the national development of wind power. Shown in parentheses are 90% confidence intervals calculated using Monte Carlo simulations with 5000 draws. P-values are derived from a two-sided complete combinatorial test for independent distributions between *standard OE* and *theory-driven OE*.

6.4 Comparison across elicitation formats

In this section, to assess convergent validity, we compare WTA estimates from the SBC format with those from the DB and OE formats, in order to assess convergent validity. For SBC and DB, we report estimates for the power function specification in equation (13), while for OE we use the Quasi-Poisson model in equation (14). Figure 4 presents the comparison across elicitation formats and preferences for wind power. To improve the visual comparison, we report all WTA estimates in Panel A and then focus only on SBC and DB in Panel B.

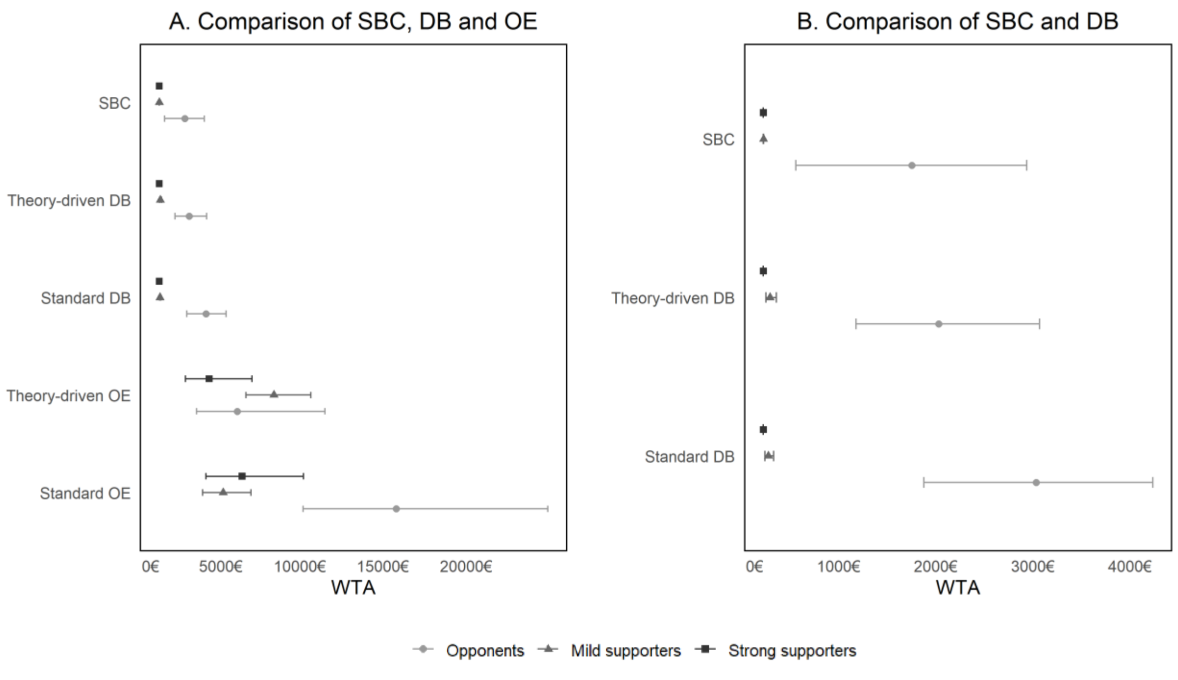
Panel A illustrates that, for any given level of support, the estimates derived from both versions of OE are substantially higher than those obtained from SBC or DB. These differences are large in magnitude and statistically significant, providing strong evidence against convergent validity for both versions of the OE format. When asked an open-ended question, even strong supporters of wind power state large WTAs, which are comparable in magnitude to those estimated in the SBC and DB formats for opponents. Thus, the results by Vossler and Holladay (2018), who find convergent validity for *theory-driven OE* in the WTP context, do not generalize to the elicitation of WTA. While the *theory-driven OE* appears to slightly discourage strategic behavior among opponents compared with the *standard OE*, the differences relative to the SBC and DB results remain large and statistically significant.

Panel B shows that the SBC and DB formats yield WTA estimates of similar magnitude and with comparable patterns of heterogeneity across preferences for wind power. Considering first the opponents, both formats estimate compensation amounts ranging from €1500 to €2500. However, we observe a slight difference between the two versions of DB. The s*tandard DB* yields slightly larger WTA estimates than SBC, with the mean estimate in SBC falling just outside the 90%

confidence interval observed in DB (but inside the 95% confidence interval). On the other hand, the *theory-driven DB* produces WTA estimates that are similar in magnitude and almost indistinguishable from those obtained from SBC.[10]

Regarding the strong supporters, SBC and DB estimate WTAs that are not significantly different from zero. A small difference between the two formats emerges for mild supporters. The SBC estimates a WTA which is not significantly different from zero, while both DB versions estimate values on the order of €50, with a relatively large confidence interval ranging from about €20 to €120 (see Table 5 and Table 6). Although the point estimate in SBC lies outside the confidence intervals in both versions of DB, the differences in WTAs are relatively small compared with the magnitudes tested in our survey, especially considering that the smallest non-zero compensation amount we offered was €100. For this reason, we regard these differences as minor and potentially attributable to the precision of our survey rather than to actual elicitation bias. Exploring this issue further would require an ad-hoc follow-up study.

Figure 3. WTA by elicitation format and preferences for wind power



Note: Error bars represent 90% confidence intervals.

[10] Note that, in the comparison between the SBC and DB formats, we do not test for statistical significance, as the complete combinatorial test for independent distributions (Poe et al., 2005) is not applicable in this context. The DB estimates are based on a subsample of the data used to estimate WTA in SBC, meaning that the resulting WTA distributions are neither fully independent nor fully dependent. As a result, we assess comparability by checking whether the point estimates in SBC fall within the confidence intervals of the DB estimates.

6.5 *Robustness tests*

In this section we assess the robustness of our results by examining alternative model specifications and sample compositions. Here, we report the WTA estimates and in Table S5 through Table S7 we present the parameter estimates.

First, we consider the findings based on the SBC data. Our structural models assume that respondents compare the utility derived from a given compensation amount against the disutility associated with the wind farm, taking current income as the reference point. To test the robustness of this assumption, we estimate a model in which compensation is expressed as a share of a respondent's income.[11] The results obtained from this alternative specification are shown in Table 10, R1. Because the WTA resulting from this specification is calculated as a share of annual income, the value reported in R1 is obtained by multiplying that share by the median annual income observed in our sample. Results derived from this specification are consistent with those reported in Table 5. Next, R2 removes from the analysis respondents who perceive the survey as lacking policy consequentiality, because higher perceived policy consequentiality corresponds to increased response validity (Vossler et al., 2012). Finally, R3 excludes respondents who already live within 1 km of existing wind farms, as they may be less likely to believe that new wind farms will be built in their municipalities. The results of R2 and R3 are very similar to those reported in our main analysis.

Table 10. Robustness checks for SBC model estimates

	R1 (compensation defined as share of income)	R2 (respondents lacking consequentiality beliefs excluded)	R3 (respondents living near wind farms excluded)
Opponents	1845	1599	1674
	[668; 3980]	[202; 3114]	[350; 3091]
Mild supporters	0.1	0.1	0.1
	[0; 0.1]	[0; 0.2]	[0; 0.4]
Strong supporters	0	0	0
N	994	845	975

Note: R1: compensation defined as a share of annual income. R2: excludes respondents who perceive the survey as inconsequential. R3: excludes respondents living near wind farms. With R1, WTA is calculated by multiplying by the median annual income in the sample (€36000). Shown in parentheses are 90% confidence intervals calculated using Monte Carlo simulations with 5000 draws.

[11] In the survey, net monthly income is measured using three categories (see Table 1). To calculate annual income, we use the midpoint of each income category as a proxy and set the upper bound at €5000. This yields annual income levels of €12000, €36000, and €60000.

Second, for DB we run the same robustness tests as for SBC (see Table 11, R4 to R6). In addition, we estimate WTA including the highest compensation amount (€20000) offered in the second referendum (R7), which is excluded from the main analysis to facilitate comparability of findings with SBC. We also examine whether our estimates are sensitive to our treatment of respondents who did not see the second referendum because they voted 'yes' in the first one when offered €0. To this end, we (i) assign those respondents to the DB version other than the one used in the main analysis (R8); (ii) exclude them from the analysis of DB, as they did not see either version of the second referendum (R9). The WTAs obtained from all the robustness tests are largely consistent with our main estimates for the DB format, reported in Table 7. Furthermore, when excluding respondents who perceive the survey as lacking policy consequentiality, the point estimates for WTAs estimated from the *theory-driven DB* converge even further on the WTA in the SBC. format This result suggests that the theory-driven refinements might enhance truthful voting in DB, especially among respondents who perceive the survey as consequential.

Table 11. Robustness checks for DB model estimates

	R4 (compensation defined as share of income)	R5 (respondents lacking consequentiality beliefs excluded)	R6 (respondents living near wind farms excluded)	R7 (€20000 offers included)	R8 ('yes' votes to €0 in first referendum assigned to other DB)	R9 ('yes' votes to €0 in first referendum excluded)
Standard DB						
Opponents	3599	2263	2919	2750	2978	2829
	[2166; 5569]	[1131; 3567]	[1702; 4163]	[1612; 3915]	[1744; 4246]	[1665; 4055]
Mild supporters	47	29	56	50	57	97
	[15; 110]	[6; 74]	[18; 117]	[16; 108]	[18; 118]	[42; 174]
Strong supporters	0	0	0	0	0	1
						[0; 15]
Theory-driven DB						
Opponents	2194	1552	1923	1921	1685	1721
	[1153; 3686]	[725; 2549]	[993; 2990]	[1018; 2958]	[864; 2631]	[905; 2672]
Mild supporters	61	55	65	65	58	112
	[21; 136]	[17; 120]	[23; 134]	[23; 134]	[20; 121]	[51; 198]
Strong supporters	0	0	0	0	0	1
						[0; 1]
N	994	845	975	994	994	950

Note: R4: compensation defined as share of annual income. R5: excludes respondents who perceive the survey as inconsequential. R6: excludes respondents living near wind farms. R7: assigns 'yes' to the €0 offer in the first referendum to the DB version other than the one in the main analysis. R8: excludes respondents who voted 'yes' to €0 in the first referendum. In R4, WTA is calculated by multiplying by the median annual income in the sample (€36000). Shown in parentheses are 90% confidence intervals calculated using Monte Carlo simulations with 5000 draws.

Finally, for the OE format, we use the same sample restrictions as for the SBC format (see Table 12, R10 and R11). In addition, we vary the upper threshold for including WTA in the analysis.

Instead of using €75000 as the cut-off, we use €40000, which corresponds to the 90th percentile (R12), and €100000, which corresponds to the 95th percentile (R13). In general, the point estimates in these robustness checks remain largely consistent with those obtained in our main analysis, reported in Table 9. Restricting the sample to respondents who hold policy consequentiality beliefs yields WTA estimates that are more uniform across preferences for wind power and version of OE than in the main analysis, except for opponents of wind power in *standard OE,* whose WTA is estimated to be much higher than for strong supporters or mild supporters. As expected, if we exclude respondents with stated WTA above the 90th percentile, WTA estimates are slightly lower than those of our main analysis. On the other hand, increasing the threshold to the 95th percentile does not noticeably affect our point estimates but yields wider confidence intervals.

Table 12. Robustness checks for OE model estimates

	R10 (respondents lacking consequentiality beliefs excluded)	R11 (respondents living near wind farms excluded)	R12 (WTA > 90th percentile excluded)	R13 (WTA > 95th percentile excluded)
Standard OE				
Opponents	9568	12558	7942	14217
	[4686; 19558]	[7105; 22259]	[4860; 12926]	[6901; 28952]
Mild supporters	4059	3925	3470	6576
	[2758; 5992]	[2718; 5694]	[2670; 4531]	[4438; 9812]
Strong supporters	4927	4967	3560	7762
	[2711; 9095]	[2803; 8731]	[2233; 5636]	[4107; 14846]
Theory-driven OE				
Opponents	5338	4900	4680	9219
	[2420; 12001]	[2321; 10443]	[2799; 7846]	[4358; 19888]
Mild supporters	5883	6888	3685	8848
	[4204; 8190]	[5198; 9105]	[2810; 4813]	[6158; 12658]
Strong supporters	3422	2998	1930	2998
	[1800; 6579]	[1575; 5596]	[1114; 3300]	[1258; 7460]
N	265	302	297	315

Note: R10: excludes respondents who perceive the survey as inconsequential. R11: excludes respondents living near wind farms. R12: excludes respondents with WTA above the 90th percentile. R13: excludes respondents with WTA above the 95th percentile. Shown in parentheses are 90% confidence intervals calculated using Monte Carlo simulations with 5000 draws.

7 Conclusions

This study advances the literature on stated preference methods by assessing the incentive compatibility of alterative elicitation formats for estimating WTA in the field. Our empirical application focuses on the acceptability of the installation of wind farms in respondents' municipalities.

Our results provide strong evidence against the convergent validity of the OE format, whether in its standard or theory-driven version informed by mechanism-design theory. This finding differs from those obtained using a theory-driven version of OE for eliciting WTP (Vossler and Holladay, 2018; Vossler and Zawojska, 2020) but reinforces concerns regarding the vulnerability of this format to strategic behavior, especially among respondents who strongly oppose the project under valuation. The DB format, on the other hand, yields encouraging results, both on average and when accounting for heterogeneity in preferences. Overall, our findings indicate that using consequential elicitations, WTA estimates are similar in magnitude for the SBC and DB formats, especially for *theory-driven DB*. This is encouraging, as DB provides higher statistical efficiency than SBC. Nonetheless, further research is needed to determine whether theory-based refinements can consistently ensure incentive compatibility in DB formats. Similarly, future research should assess the generalizability of these findings to other applications.

Our paper also proposes a novel approach to estimating WTA (and WTP) which relaxes the conventional assumption of linear utility and allows instead for non-linear utility of compensation. While the assumption of linear utility may be appropriate when monetary stakes are small, our findings suggest that studies involving higher stakes should consider more flexible functional forms.

Our empirical findings also offer policy implications. They imply that acceptability of wind farms is highly heterogeneous, with a large share of our sample (about one-third) characterized by protest responses, i.e., respondents who would oppose the installation of new wind farms for any compensation amount. In line with common practice in the field (e.g., Ferreira and Gallagher, 2010; Villanueva et al., 2017), we removed such responses from our empirical analysis. Yet, protesters are relevant to policymaking and ignoring them would underestimate the extent of public opposition.

Among respondents who oppose wind farms but are willing to consider the trade-off proposed in the contingent valuation, WTA ranges between €1500 and €1800. Most respondents willing to consider the trade-off proposed would, however, accept the installation of new wind farms in their municipalities for modest financial compensation (below €100). This occurs without evidence of motivation crowding-out or backlash, countering concerns raised in previous studies (Frey et al., 1996). Overall, our upper bound of the WTA estimates is broadly consistent with existing measures used in France. For example, they align with the annual discount on households' electricity bills of €300 per year over a five-year period offered by the energy company *RWE* for a wind farm similar in size to the one considered in this study. These findings suggest that compensation can be an effective and politically viable tool for encouraging public acceptance of renewable energy infrastructure, provided that heterogeneity in preferences and local context are adequately considered.

Finally, this study focuses on financial compensation provided to households, which is the most common strategy used by energy companies to garner support among residents living close to new wind farms. While this approach is widely used, it is not the only possible way to encourage local support (e.g., Garcia et al., 2016). Future research can build on our design to examine, using an incentive-compatible valuation, the impact of other strategies, such as allowing residents to invest directly in wind farms.

References

Alberini, A., and Bigano, A. (2015). How effective are energy-efficiency incentive programs? Evidence from Italian homeowners. *Energy Economics*, *52*, S76-S85. https://doi.org/10.1016/j.eneco.2015.08.021

Aizaki, H. (2015). *mded: Measuring the difference between two empirical distributions*. https://CRAN.R-project.org/package=mded

Andersen, S., Harrison, G. W., Lau, M. I., and Rutström, E. E. (2008). Eliciting risk and time preferences. *Econometrica, 76*(3), 583–618. https://doi.org/10.1111/j.1468-0262.2008.00848.x

Andor, M. A., Frondel, M., and Horvath, M. (2021). Consequentiality, elicitation formats, and the willingness to pay for green electricity: evidence from Germany. *Land Economics*, *97*(3), 626-640. https://doi.org/10.3368/le.97.3.626

Arrow, K., Solow, R., Portney, P. R., Leamer, E. E., Radner, R., and Schuman, H. (1993). *Report of the NOAA Panel on Contingent Valuation*.

Bateman, I., and Willis, K. G. (Eds.). (2001). *Valuing environmental preferences: Theory and practice of the contingent valuation method in the US, EU, and developing countries*. Oxford University Press.

Becker, G. M., DeGroot, M. H., and Marschak, J. (1964). Measuring utility by a single-response sequential method. *Behavioral Science, 9*(3), 226–232. https://doi.org/10.1002/bs.3830090304

Brandenburg. (2019). *Gesetz- und Verordnungsblatt für das Land Brandenburg. Teil I – Gesetze* (Vol. 30, No. 30). Ministry of the Interior and Municipal Affairs. https://bravors.brandenburg.de/sixcms/media.php/76/GVBl_I_30_2019.pdf

Cameron, T. A., Ethier, R. G., Poe, G. L., and Schulze, W. D. (2002). Alternative non-market value-elicitation methods: Are the underlying preferences the same? *Journal of Environmental Economics and Management, 44*(3), 391–425. https://doi.org/10.1006/jeem.2001.1210

Cameron, T. A., and Huppert, D. D. (1989). OLS versus ML estimation of non-market resource values with payment-card interval data. *Journal of Environmental Economics and Management, 17*(3), 230–246. https://doi.org/10.1016/0095-0696(89)90018-1

Carson, R. T. (2012). Contingent valuation: A practical alternative when prices aren't available. *Journal of Economic Perspectives, 26*(4), 27–42. https://doi.org/10.1257/jep.26.4.27

Carson, R. T., and Groves, T. (2007). Incentive and informational properties of preference questions. *Environmental and Resource Economics, 37*(1), 181–210. https://doi.org/10.1007/s10640-007-9124-5

Carson, R. T., Groves, T., and List, J. A. (2014). Consequentiality: A theoretical and experimental exploration of a single binary choice. *Journal of the Association of Environmental and Resource Economists, 1*(1–2), 171–207. https://doi.org/10.1086/676450

Cour des comptes. (2023). *Soutiens éolien* (Rapport S2023-0909). https://www.ccomptes.fr/sites/default/files/2023-10/20231017-S2023-0909-Soutiens-eolien_0.pdf

Cummings, R. G., Elliott, S., Harrison, G. W., and Murphy, J. (1997). Are hypothetical referenda incentive compatible? *Journal of Political Economy, 105*(3), 609–621. https://doi.org/10.1086/262084

Cummings, R. G., and Taylor, L. O. (1999). Unbiased value estimates for environmental goods: A cheap-talk design for the contingent valuation method. *American Economic Review, 89*(3), 649–665. https://doi.org/10.1257/aer.89.3.649

Dong, L., Lang, C., and Parent, J. (2024). Focusing the view: Improved methods for assessing viewshed impacts of onshore wind turbines. *Journal of Environmental Economics and Management, 128*, 103068. https://doi.org/10.1016/j.jeem.2024.103068

Enevoldsen, P., and Sovacool, B. K. (2016). Examining the social acceptance of wind energy: Practical guidelines for onshore wind project development in France. Renewable and Sustainable Energy Reviews, 53, 178-184. https://doi.org/10.1016/j.rser.2015.08.041

Eurostat. (2020). *Population density by NUTS 3 region*. https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_r_d3densandlang=en

Fezzi, C., Menapace, L., and Raffaelli, R. (2021). Estimating risk preferences integrating insurance choices with subjective beliefs. *European Economic Review, 135*, 103717. https://doi.org/10.1016/j.euroecorev.2021.103717

Ferreira, S., and Gallagher, L. (2010). Protest responses and community attitudes toward accepting compensation to host waste disposal infrastructure. *Land Use Policy, 27*(2), 638–652. https://doi.org/10.1016/j.landusepol.2009.08.020

Frey, B. S., Oberholzer-Gee, F., and Eichenberger, R. (1996). The old lady visits your backyard: A tale of morals and markets. *Journal of Political Economy, 104*(1), 27–47. https://doi.org/10.1086/262060

Frondel, M., Sommer, S., and Tomberg, L. (2021). WTA-WTP disparity: the role of perceived realism of the valuation setting. *Land Economics*, *97*(1), 196-206. https://doi.org/10.3368/le.97.1.030419-0033R1

Garcia, J. H., Cherry, T. L., Kallbekken, S., and Torvanger, A. (2016). Willingness to accept local wind energy development: Does the compensation mechanism matter? *Energy Policy, 99*, 165–173. https://doi.org/10.1016/j.enpol.2016.09.046

Germeshausen, R., Heim, S., and Wagner, U. J. (2025). Support for renewable energy: The case of wind power. *Journal of Public Economics*, *250*, 105468. https://doi.org/10.1016/j.jpubeco.2025.105468

Gibbons, S. (2015). Gone with the wind: Valuing the visual impacts of wind turbines through house prices. *Journal of Environmental Economics and Management, 72*, 177–196. https://doi.org/10.1016/j.jeem.2015.04.006

Hanemann, W. M. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics*, *66*(3), 332-341. https://doi.org/10.2307/1240800

Hanemann, M., Loomis, J., and Kanninen, B. (1991). Statistical efficiency of double-bounded dichotomous choice contingent valuation. *American Journal of Agricultural Economics, 73*(4), 1255–1263. https://doi.org/10.2307/1242453

Harrison, G. W., List, J. A., and Towe, C. (2007). Naturally occurring preferences and exogenous laboratory experiments: A case study of risk aversion. *Econometrica, 75*(2), 433–458. https://doi.org/10.1111/j.1468-0262.2006.00753.x

Holt, C. A., and Laury, S. K. (2002). Risk aversion and incentive effects. *American Economic Review, 92*(5), 1644–1655. https://doi.org/10.1257/000282802762024700

Howard, G., Whitehead, J. C., and Hochard, J. (2021). Estimating discount rates using referendum-style choice experiments: An analysis of multiple methodologies. *Journal of Environmental Economics and Management*, *105*, 102399. https://doi.org/10.1016/j.jeem.2020.102399

INSEE. (2017). *Revenu, niveau de vie et pauvreté en 2017*. https://www.insee.fr/fr/statistiques/4261081?sommaire=4261132

INSEE. (2022). *Observatoire des inégalités*. https://www.inegalites.fr/niveau-de-diplome-de-la-population

Johnston, R. J., Boyle, K. J., Adamowicz, W. L., Bennett, J., Brouwer, R., Cameron, T. A., Hanemann, W. M., Hanley, N., Ryan, M., Scarpa, R., Tourangeau, R., and Vossler, C. A. (2017). Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists, 4*(2), 319–405. https://doi.org/10.1086/691697

Lloyd-Smith, P., and Adamowicz, W. (2018). Can stated measures of willingness-to-accept be valid? Evidence from laboratory experiments. *Journal of Environmental Economics and Management, 91*, 133–149. https://doi.org/10.1016/j.jeem.2018.07.003

Lundin, E. (2024). Wind power and the cost of local compensation schemes: A Swedish revenue-sharing policy simulation. *Energy Economics, 135*, 107632. https://doi.org/10.1016/j.eneco.2024.107632

Messer, K. D., Poe, G. L., Rondeau, D., Schulze, W. D., and Vossler, C. A. (2010). Social preferences and voting: An exploration using a novel preference revealing mechanism. *Journal of Public Economics, 94*(3–4), 308–317. https://doi.org/10.1016/j.jpubeco.2009.12.004

Penn, J. M., and Hu, W. (2021). The extent of hypothetical bias in willingness to accept. *American Journal of Agricultural Economics, 103*(1), 126–141. https://doi.org/10.1111/ajae.12121

Poe, G. L., Giraud, K. L., and Loomis, J. B. (2005). Computational methods for measuring the difference of empirical distributions. *American Journal of Agricultural Economics, 87*(2), 353–365. https://doi.org/10.1111/j.1467-8276.2005.00727.x

R Core Team. (2025). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/

Rowe, R. D., D'Arge, R. C., and Brookshire, D. S. (1980). An experiment on the economic value of visibility. *Journal of Environmental Economics and Management, 7*(1), 1–19. https://doi.org/10.1016/0095-0696(80)90018-2

Saxony. (2024). *Sächsisches Gesetz- und Verordnungsblatt (SächsGVBl.), No. 7*. Saxon State Chancellery. https://www.revosax.sachsen.de/vorschrift_gesamt/20864/48203.html

Strazzera, E., Mura, M., and Contu, D. (2012). Combining choice experiments with psychometric scales to assess the social acceptability of wind energy projects: A latent class approach. *Energy Policy, 48*, 334–347. https://doi.org/10.1016/j.enpol.2012.05.037

Vásquez-Lavín, F., Carrasco, M., Barrientos, M., Gelcich, S., and Oliva, R. D. P. (2021). Estimating discount rates for environmental goods: Are People's responses inadequate to frequency of payments?. *Journal of Environmental Economics and Management*, *107*, 102446. https://doi.org/10.1016/j.jeem.2021.102446

Villanueva, A. J., Glenk, K., and Rodríguez-Entrena, M. (2017). Protest responses and willingness to accept: Ecosystem services providers' preferences towards incentive-based schemes. *Journal of Agricultural Economics, 68*(3), 801–821. https://doi.org/10.1111/1477-9552.12211

Vossler, C. A., Doyon, M., and Rondeau, D. (2012). Truth in consequentiality: Theory and field evidence on discrete choice experiments. *American Economic Journal: Microeconomics, 4*(4), 145–171. https://doi.org/10.1257/mic.4.4.145

Vossler, C. A., and Holladay, J. S. (2018). Alternative value-elicitation methods in contingent valuation: Mechanism design and convergent validity. *Journal of Public Economics, 165*, 133–145. https://doi.org/10.1016/j.jpubeco.2018.07.004

Vossler, C. A., and Zawojska, E. (2020). Behavioral drivers or economic incentives? Toward a better understanding of elicitation effects in stated preference studies. *Journal of the Association of Environmental and Resource Economists*, *7*(2), 279-303. https://doi.org/10.1086/706645

Vossler, C. A., Bergeron, S., Doyon, M., and Rondeau, D. (2023). Revisiting the gap between the willingness to pay and willingness to accept for public goods. *Journal of the Association of Environmental and Resource Economists, 10*(2), 413–445. https://doi.org/10.1086/721995

Vossler, C. A., Keiser, D. A., Kling, C. L., and Phaneuf, D. J. (2025). Information scripts and the incentive compatibility of discrete choice experiments. *Journal of the Association of Environmental and Resource Economists*. https://doi.org/10.1086/731527

Welsh, M. P., and Poe, G. L. (1998). Elicitation effects in contingent valuation: Comparisons to a multiple-bounded discrete choice approach. *Journal of Environmental Economics and Management, 36*(2), 170–185. https://doi.org/10.1006/jeem.1998.1043

Whittington, D., Adamowicz, W., and Lloyd-Smith, P. (2017). Asking willingness-to-accept questions in stated preference surveys: A review and research agenda. *Annual Review of Resource Economics, 9*, 317–336. https://doi.org/10.1146/annurev-resource-121416-125602

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). MIT Press.

Zawojska, E., Bartczak, A., and Czajkowski, M. (2019). Disentangling the effects of policy and payment consequentiality and risk attitudes on stated preferences. *Journal of Environmental Economics and Management, 93*, 63–84. https://doi.org/10.1016/j.jeem.2018.11.007

Supplementary Material for: "Beyond the single binary choice format for eliciting willingness to accept: Evidence from a field study on onshore wind farms"

Valeria Fanghella, Carlo Fezzi, Joachim Schleich, Carine Sebi*

List of content

* Valeria Fanghella: EDHEC Business School, France; corresponding author: valeria.fanghella@edhec.edu. Carlo Fezzi: University of Trento, Trento, Italy; carlo.fezzi@unitn.it. Joachim Schleich: Grenoble Ecole de Management, 12 Pierre Sémard, 38000, Grenoble, France and Fraunhofer Institute for Systems and Innovation Research, Breslauer Straße 48, 76139, Karlsruhe, Germany; joachim.schleich@grenoble-em.com. Carine Sebi: Grenoble Ecole de Management, 12 Pierre Sémard, 38000, Grenoble, France; carine.sebi@grenoble-em.com.

1 Contingent valuation[1]

[Introduction common to all elicitation formats]

In this section, **you will express your preferences regarding the installation of an onshore wind farm in your municipality**. These wind turbines convert wind energy into electricity and are installed on land. **We, the researchers conducting this study, solemnly pledge that all the information contained in this survey, including in this section, is accurate and truthful.** We therefore ask you to read the instructions on the next page carefully and to think before responding.

We are conducting this survey in collaboration with a French energy company that plans to build several new onshore wind farms in France over the coming years. Although the project details have not yet been finalized, each wind farm is expected to include 5 wind turbines, each 120 meters tall, and to supply electricity to approximately 9000 households. The turbines will be installed in compliance with regulations, maintaining a minimum distance of 500 meters from the nearest buildings. The expected lifespan of the wind farms is 20 years, after which they will be dismantled in accordance with regulatory requirements.

[Single binary choice]

The energy company has identified several municipalities in France as suitable locations for the installation of wind farms (based on criteria such as available land, existing infrastructure, and wind energy potential). **You live in one of these municipalities. We are conducting this survey to help the energy company make informed decisions about where to locate new wind farms.** Therefore, it is important for us to know your opinion, as well as those of other households in your municipality. **Your response may influence the energy company's decision to install a wind farm in your municipality.**

The energy company plans to voluntarily compensate all households in the municipality where a new wind farm is installed. **This lump-sum payment would be the same for all households and would be made once the construction of the wind farm is completed.**

That is why we are proposing you an advisory referendum and asking you whether or not you would accept the installation of the wind farm in your municipality for the proposed compensation amount.

[1] Translation by the authors from French.

The results of the advisory referendum are not binding on the energy company, but are rather advisory in nature. They will be shared with the energy company and may influence its decision to install the wind farm in your municipality.

Please consider the following advisory referendum. Before casting your vote, think about the amount of compensation you would be willing to accept, if any. In the following referendum, vote “YES” if you accept the installation of the wind farm in your municipality for the amount of compensation proposed below; vote “NO” if you do not.

If the energy company paid your household compensation of €X, would you vote in favor of the installation of the wind farm in your municipality?

- Yes
- No

[Standard double-bounded binary choice; following the referendum of the single binary choice]

We will now present you with a second advisory referendum and ask you to vote “YES” or “NO” for a different compensation amount.

If the energy company paid your household compensation of €X, would you vote in favor of the installation of the wind farm in your municipality?

- Yes
- No

[Theory-driven double-bounded binary choice; following the referendum of the single binary choice]

Due to uncertainties related to the future costs and revenues generated by the wind farm, the final budget available for compensation is still unknown. That is why we are proposing you a second advisory referendum and ask you to vote “YES” or “NO” for a different compensation amount.

Once the final budget information is known, we will be able to compare the proposed compensation with the amounts that you and the other residents of your municipality would like to receive in order to accept the installation of the wind farm. We will then be able to determine the percentage of support or opposition in your municipality to the wind farm, based on the amount of compensation proposed.

If the energy company paid your household compensation of €X, would you vote in favor of the installation of the wind farm in your municipality?

- Yes
- No

Please note that the budget available for compensation remains uncertain at this time. That is why we are asking you to vote again on a different compensation amount. This way, once the final budget is confirmed, we will be able to determine the percentage of support or opposition to the wind farm in your municipality based on the amount of compensation proposed.

[Standard open-ended]

The energy company has identified several municipalities in France as suitable locations for the installation of wind farms (based on criteria such as available land, existing infrastructure, and wind energy potential). **You live in one of these municipalities. We are conducting this survey to help the energy company make informed decisions about where to locate new wind farms.** Therefore, it is important for us to know your opinion, as well as those of other households in your municipality. **Your response may influence the energy company's decision to install a wind farm in your municipality.**

The energy company plans to voluntarily compensate all households in the municipality where a wind farm is installed. **This lump-sum payment would be paid to households once the construction of the wind farm is completed.**

That is why we are proposing you an advisory referendum and asking you to indicate the minimum compensation amount that the energy company would need to pay you to vote in favor of installing the wind farm in your municipality.

The results of the advisory referendum are not binding on the energy company, but are rather advisory in nature. They will be shared with the energy company and may influence its decision to install the wind farm in your municipality.

Please consider the following advisory referendum. Before entering an amount, think about the amount of compensation you would be willing to accept, if any. In the space below, enter the minimum amount in euros (€) that the energy company would need to pay you to vote in favor of installing the wind farm in your municipality.

What is the minimum amount of compensation the energy company would have to pay you to get you to vote in favour of the installation of the wind farm in your municipality?

- Minimum compensation amount in €: ___________
- I do not want a wind farm installed in my municipality, regardless of the level of compensation.

[Theory-driven open-ended]

The energy company has identified several municipalities in France as suitable locations for the installation of wind farms (based on criteria such as available land, existing infrastructure, and wind energy potential). **You live in one of these municipalities. We are conducting this survey to help the energy company make informed decisions about where to locate new wind farms.** Therefore, it is important for us to know your opinion, as well as those of other households in your municipality. **Your response may influence the energy company's decision to install a wind farm in your municipality.**

The energy company plans to voluntarily compensate all households in the municipality where a new wind farm is installed. **This lump-sum payment would be the same for all households and would be made once the construction of the wind farm is completed.**

Due to uncertainties related to the future costs and revenues generated by the wind farm, the final budget available for compensation is still unknown. That is why we are proposing you an advisory referendum and asking you to indicate the minimum compensation amount that the energy company would need to pay you to vote in favor of installing the wind farm in your municipality. Once the final budget information is known, we will be able to compare the proposed compensation with the amounts that you and the other residents of your municipality would like to receive in order to accept the installation of the wind farm. We will then be able to determine the percentage of support or opposition in your municipality to the wind farm, based on the amount of compensation proposed.

The results of the advisory referendum are not binding on the energy company, but are rather advisory in nature. They will be shared with the energy company and may influence its decision to install the wind farm in your municipality.

Please consider the following advisory referendum. Keep in mind that if you are asked to indicate the minimum amount of compensation you would be willing to accept, it is because, at this time, the budget available to compensate households living in the municipality where the new wind farm will be installed is uncertain. Before entering an amount, think about the amount of compensation you would be willing to accept, if any. In the space below, enter the minimum amount in euros (€) that the energy company would need to pay you to vote in favor of installing the wind farm in your municipality.

What is the minimum amount of compensation the energy company would have to pay you to get you to vote in favour of the installation of the wind farm in your municipality?

- Minimum compensation amount in €: ___________
- I do not want a wind farm installed in my municipality, regardless of the level of compensation.

Please note that the budget available for compensation remains uncertain at this time. That is why we are asking you the minimum amount that the energy company would need to pay you to vote in favor of installing the wind farm in your municipality. This way, once the final budget is confirmed, we will be able to determine the percentage of support or opposition to the wind farm in your municipality based on the amount of compensation proposed.

2 Attrition and randomization check

Table S1 shows how the probability of failing at least one attention check relates to the elicitation format and respondents' characteristics. We estimate a Probit model where the dependent variable equals 1 if the respondent failed at least one attention check, and 0 if they completed the survey. Some individual characteristics such as age and gender are negatively related to failing an attention check. However, we find no significant differences across elicitation formats. This suggests that excluding inattentive respondents does not introduce self-selection into the elicitation formats.

Table S13. Characteristics of respondents failing at least one attention check

	Failed attention check
Theory-driven DB	0.030
	(0.019)
Standard OE	0.011
	(0.024)
Theory-driven OE	0.003
	(0.023)
Age	-0.006***
	(0.000)
Female	-0.048***
	(0.016)
Graduate degree	-0.002
	(0.020)
Income < 2000 €/month	-0.001
	(0.018)
Income >= 4000 €/month	-0.029
	(0.021)
N	2424

Note: Results from Probit model, marginal effects. *Standard DB* is used as baseline format. *p-value < 0.1, **p-value < 0.05, ***p-value < 0.01.

In Table S2 and Table S3, we report the results of the randomization checks for the full sample and the final sample, respectively. Overall, randomization was successful in both samples. In the full sample, income distribution shows a small imbalance (at the 10% significance level) across elicitation formats (see Table S2). This imbalance is no longer present in the final sample.

In the final sample elicitation formats and preferences for wind power are related at the 10% level only (see Table S3). This is due to a slight difference in the distribution of preferences for wind power between *standard DB* and *theory-driven DB* (χ^2 test of independence, p-value = 0.081). The direction of this difference, however, is ambiguous, leading to preferences for wind power that, on average, do not differ significantly between the two versions of DB ($\bar{x}_{standardDB} = 2.77$, $\bar{x}_{theory-drivenDB} = 2.69$; two-tailed *t*-test, p-value = 0.12).

Table S14. Descriptive statistics by elicitation format (full sample)

	DB		*OE*		
	Standard	*Theory-driven*	*Standard*	*Theory-driven*	P-value
N	699	658	289	303	
Female (%)	45.21	44.53	48.10	46.20	0.773
Age (mean)	52	53	52	51	0.279
Income (%)					0.096
< 2,000 €/month	31.19	29.03	28.72	30.36	
Between 2,000 and 3,900 €/month	50.07	49.39	57.44	52.81	
>= 4,000 €/month	18.74	21.58	13.84	16.83	
Graduate degree (%)	16.45	18.84	18.34	17.82	0.702
Support for wind power (%)					0.219
Strongly oppose	10.59	11.25	13.84	13.86	
Oppose	20.03	22.04	22.49	23.76	
Support	51.07	52.43	50.17	45.21	
Strongly support	18.31	14.29	13.49	17.16	

Note: For the variable age the p-value is from an ANOVA test, while for all other variables it is from a χ^2 test of independence.

Table S15. Descriptive statistics by elicitation format (final sample)

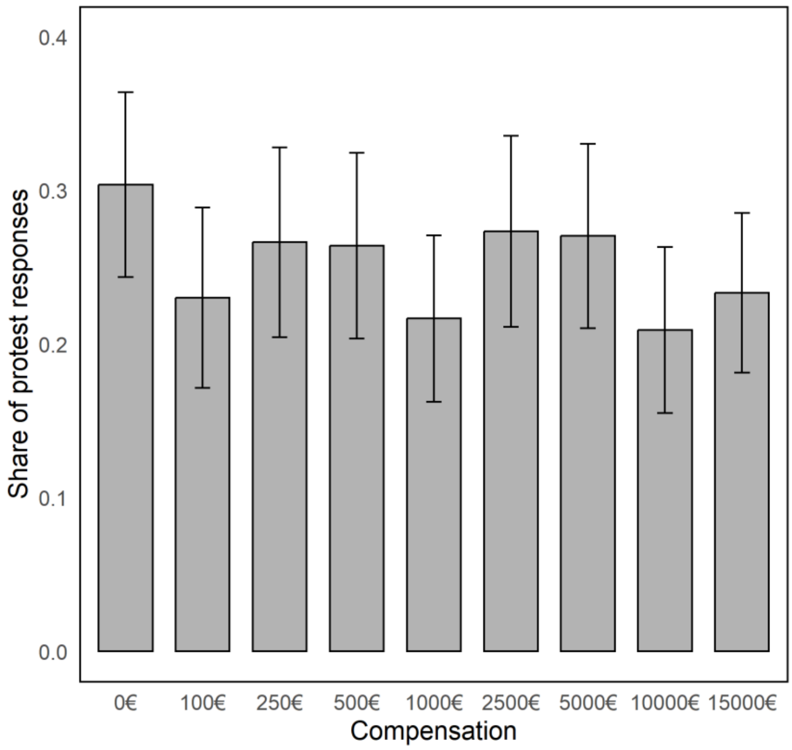
	DB		*OE*		
	Standard	*Theory-driven*	*Standard*	*Theory-driven*	P-value
N	524	470	150	158	
Female (%)	45.04	42.77	46.00	42.41	0.819
Age (mean)	51	52	51	51	0.854
Income (%)					0.561
< 2,000 €/month	31.30	30.00	29.33	24.68	
Between 2,000 and 3,900 €/month	49.81	49.57	54.67	56.96	
>= 4,000 €/month	18.89	20.43	16.00	18.35	
Graduate degree (%)	15.46	20.00	22.00	20.89	0.125
Support for wind power (%)					0.092
Strongly oppose	4.2	2.13	2.67	1.9	
Oppose	12.4	13.19	7.33	10.76	
Support	59.54	65.11	68.0	58.86	
Strongly support	23.85	19.57	22.0	28.48	

Note: For the variable age the p-value is from an ANOVA test, while for all other variables it is from a χ^2 test of independence.

3 Relation between compensation amount and protest responses

To analyze the relation between compensation and probability to give a protest response, we focus on the compensation amount offered in SBC. Protest responses should be independent of the amount offered, as they reflect opposition to the trade-off itself rather than to the level of compensation. Accordingly, Figure S1 does not show a systematic relationship between the probability of a protest response and the compensation amount offered in SBC. Similarly, estimating a Probit model with the protest response as the dependent variable and the compensation amount as a covariate yields no statistically significant relationship between the two ($\beta_{amount} = -7.9 * 10^{-6}, SE = 7.2 * 10^{-6}$, p-value = 0.265).

Figure S4. Relation between protest responses and compensation amount



Note: Error bars represent 90% confidence intervals.

4 Additional analyses and robustness checks

Figure S5. Distribution of WTA by OE version

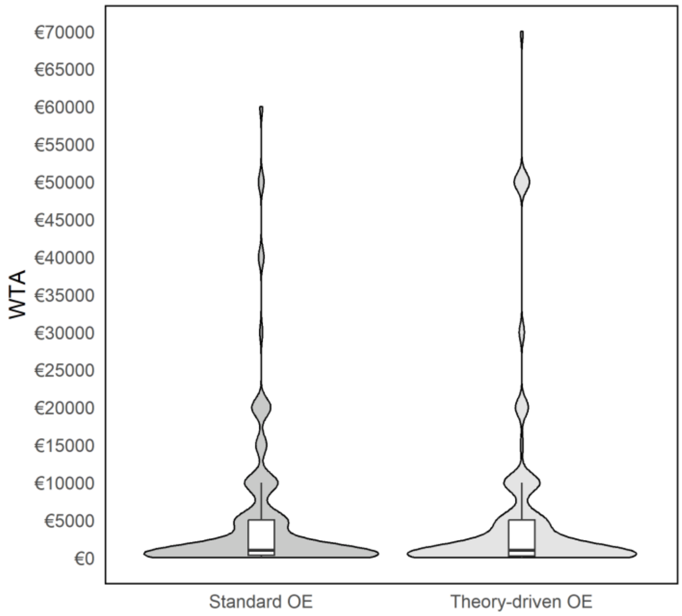


Table S16. Relation between WTA elicited via SBC, DB and OE and respondents' characteristics

	M1 SBC	M2 DB	M3 OE
Constant	-3.381***	-12.845***	8.375***
	(1.065)	(2.680)	(0.575)
ρ	0.823***	0.664***	
	(0.031)	(0.019)	
σ	2.748***	9.970***	
	(0.846)	(1.783)	
Mild supporters	3.294***	9.573***	-0.574**
	(1.058)	(1.975)	(0.302)
Strong supporters	3.989***	14.643***	-0.882***
	(1.333)	(2.897)	(0.373)
Age	-0.005	-0.015	0.012
	(0.009)	(0.024)	(0.008)
Female	0.371	0.501	0.452**
	(0.319)	(0.803)	(0.244)
Graduate degree	-0.575	-0.573	-0.116
	(0.402)	(1.033)	(0.306)
Income < 2,000 €/month	-0.210	-0.157	-0.121
	(0.337)	(0.895)	(0.274)
Income >= 4,000 €/month	-0.053	0.227	-0.015
	(0.375)	(1.016)	(0.330)

Note: M1 and M2 are estimated assuming the power-function utility, while M3 is estimated using the Quasi-Poisson model. *p-value < 0.1, **p-value < 0.05, ***p-value < 0.01.

Table S17. Robustness checks for SBC model estimates (parameters)

	R1 (compensation defined as share of income)	R2 (respondents lacking consequentiality beliefs excluded)	R3 (respondents living near wind farms excluded)
Constant	-0.630***	-4.139***	-3.757***
	(0.066)	(1.244)	(0.975)
Mild supporter	0.571***	4.070**	3.379**
	(0.072)	(1.490)	(1.079)
Strong supporter	0.685***	4.511**	4.098**
	(0.091)	(1.723)	(1.359)
ρ	0.844***	0.807***	0.822***
	(0.029)	(0.036)	(0.031)
σ	0.481***	3.172**	2.758**
	(0.045)	(1.120)	(0.845)
LL	-398.48	-320.16	-385.14
N	994	845	975

Note: All estimates derive from structural models with power-function utility. *Mild supporter* is a dummy variable for respondents who moderately support the national development of wind power; *strong supporter* is a dummy variable for respondents who strongly support the national development of wind power; respondents who oppose or strongly oppose the national development of wind power are used as the baseline. Standard errors are reported in parentheses. * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.

Table S18. Robustness checks for DB model estimates (parameters)

	R4 (compensation defined as share of income)	R5 (respondents lacking consequentiality beliefs excluded)	R6 (respondents living near wind farms excluded)	R7 (€20000 offers included)	R8 (‘yes’ votes to €0 in first referendum assigned to other DB)	R9 (‘yes’ votes to €0 in first referendum excluded)
Constant	-0.500***	-13.751***	-14.848***	-14.391***	-14.870***	-12.030***
	(0.046)	(2.799)	(2.704)	(2.550)	(2.685)	(2.050)
Mild supporter	0.365***	10.630***	10.943***	10.652***	10.951***	7.839***
	(0.050)	(2.634)	(2.427)	(2.315)	(2.408)	(1.724)
Strong supporter	0.495***	14.337***	15.139***	14.594***	14.740***	11.219***
	(0.060)	(3.373)	(3.212)	(3.041)	(3.128)	(2.312)
Theory-driven DB x Opponent	0.069	1.652	1.955	1.636	2.600	1.733
	(0.062)	(2.088)	(1.868)	(1.789)	(1.851)	(1.390)
Theory-driven DB x Mild supporter	-0.011	-0.763	-0.204	-0.345	-0.021	-0.193
	(0.033)	(1.026)	(0.960)	(0.949)	(0.951)	(0.736)
Theory-driven DB x Strong supporter	0.088	2.638	2.166	2.525	3.224*	2.089
	(0.064)	(2.067)	(1.905)	(1.884)	(1.916)	(1.446)
ρ	0.699***	0.661***	0.662***	0.663***	0.662***	0.687***
	(0.017)	(0.021)	(0.019)	(0.018)	(0.019)	(0.018)
σ	0.351***	9.973***	10.099***	10.046***	10.064***	7.577***
	(0.015)	(1.949)	(1.826)	(1.759)	(1.804)	(1.312)
LL	-1053.33	-847.46	-1010.16	-1047.29	-1026.87	-979.17
N	994	845	975	994	994	950

Note: All estimates derive from structural models with power-function utility. *Mild supporter* is a dummy variable for respondents who moderately support the national development of wind power; *strong supporter* is a dummy variable for respondents who strongly support the national development of wind power; respondents who oppose or strongly oppose the national development of wind power are used as the baseline. *Theory-driven DB* is a dummy variable for respondents who are exposed to *theory-driven DB*; *standard DB* is used as the baseline. Standard errors are reported in parentheses. * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.

Table S19. Robustness checks for OE model estimates (parameters)

	R10 (respondents lacking consequentiality beliefs excluded)	R11 (respondents living near wind farms excluded)	R12 (WTA > 90th percentile excluded)	R13 (WTA > 95th percentile excluded)
Constant	9.166***	9.438***	8.980***	9.562***
	(0.436)	(0.346)	(0.296)	(0.435)
Mild supporter	-0.858*	-1.163***	-0.828**	-0.771
	(0.495)	(0.412)	(0.336)	(0.498)
Strong supporter	-0.664	-0.927*	-0.802*	-0.605
	(0.570)	(0.489)	(0.408)	(0.585)
Theory-driven OE x Opponents	-0.584	-0.941	-0.529	-0.433
	(0.651)	(0.574)	(0.429)	(0.631)
Theory-driven OE x Mild supporter	0.371	0.562**	0.060	0.297
	(0.311)	(0.284)	(0.232)	(0.326)
Theory-driven OE x Strong supporter	-0.364	-0.505	-0.612	-0.951
	(0.541)	(0.514)	(0.431)	(0.673)
N	265	302	297	315
ϕ	19969	19521	9018	40379

Note: All estimates derive from structural models with power-function utility. *Mild supporter* is a dummy variable for respondents who moderately support the national development of wind power; *strong supporter* is a dummy variable for respondents who strongly support the national development of wind power; respondents who oppose or strongly oppose the national development of wind power are used as the baseline. *Theory-driven DB* is a dummy variable for respondents who are exposed to *theory-driven DB*; *standard DB* is used as the baseline. Standard errors are reported in parentheses. * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01.