



# Willingness to Pay for Nature Protection: Crowdfunding as a Payment Mechanism

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## Abstract

In this study, we use a discrete choice experiment to elicit the willingness-to-pay (WTP) for preventing and mitigating the effects of oil spills on marine and coastal ecosystem services, along a particularly vulnerable coastal region of mainland Portugal. We used a split-sample design to analyze the differences between two payment vehicles (PV): a mandatory extra income tax and a voluntary contribution collected by a crowdfunding campaign with a provision point mechanism and a money-back guarantee. The difference between the two PVs is examined in a setting where the local population has a negative perception of the quality of institutions. We find that respondents are more willing to contribute when presented with the crowdfunding version. Also, regardless of the payment vehicle, respondents who express a mistrust in institutions are more likely to choose the status quo. These results suggest the potential of using crowdfunding to support ecosystem services' conservation initiatives.

**Keywords** Crowdfunding · Environmental protection · Discrete choice experiment · Payment vehicle · Perceived quality of institutions

**JEL Classification** H23 · O35 · Q01 · Q51 · Q53 · Q58

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## 1 Introduction

Stated preference survey techniques, such as the Contingent Valuation approach, and Discrete Choice Experiments (DCEs), among others, are widely used to elicit the economic value of environmental goods and services. A particularly relevant issue when developing these stated preferences methods is the choice of the payment vehicle (PV). In this paper, we study the potential for a crowdfunding campaign.

Crowdfunding is a way of funding individuals and organizations by collecting money from many people, typically via online platforms. It has been used to fund innovative projects, startup companies, scientific research, as well as philanthropic or civic projects (Moritz & Block 2016). In this study, we explore the use of crowdfunding in the context of funding public policies. We explore its potential, compared to traditional funding from mandatory taxes, when public institutions raising and managing the funds are perceived negatively by the local populations. Crowdfunding campaigns are typically held online using specialized platforms, promoting transparency, efficiency, and equity in the allocation of funds (Belleflamme et al. 2015). In these campaigns, fundraisers can seek funding for a wide variety of projects or initiatives, specifying a deadline for funding and a target amount that needs to be raised to implement the project. Contributions are voluntary, and individuals pay according to their affordability, preferences, and perceptions (Moritz & Block 2016).

As crowdfunding is a recent funding tool, its potential and properties as a viable alternative PV in stated preferences studies have yet to be fully explored, and only a few valuation studies have considered it (Johnston et al. 2017; Kragt et al. 2021; Roesch-McNally & Rabotyagov 2016; Stoknes et al. 2021). Crowdfunding may present the same limitations as other Voluntary Contribution Mechanisms discussed in previous literature, namely, the incentive both for free riding in actual contributions and to overstate the true WTP in hypothetical surveys (Carson & Groves 2007; Stithou & Scarpa, 2012; Veisten & Navrud 2006; Mitchell & Carson 1989).

To improve the incentive properties of the Voluntary Contribution Mechanism (VCM), various modifications have been proposed, such as the Provision Point Mechanism (PPM) (Swallow et al. 2018; Rondeau et al. 2005). The PPM requires a monetary value or number of contributors to be met for the public good to be provided, thereby reducing the incentive to free ride as participants risk losing the public good if the threshold is not reached. Additionally, a money-back guarantee ensures contributors are refunded if the provision point is not met, mitigating the risk of losing contributions (Rondeau et al. 1999; Spencer et al. 2009). While not fully incentive compatible, the PPM with a money-back guarantee has shown to increase credibility of the hypothetical scenario, reveal a higher percentage of demand, reduce free riding, and increase the percentage of bids equal to induced values (Rondeau et al. 1999; Rose et al. 2002; Poe et al., 2002; Rondeau et al. 2005; Murphy et al. 2005). Both mechanisms are inherent characteristics of crowdfunding campaigns, as discussed in the paper.

A discrete choice experiment was designed to elicit the WTP for preventing and mitigating the effects of oil spills on marine and coastal ecosystem services along a particularly vulnerable coastal region of mainland Portugal. We used a split-sample design to analyze the differences between the two PVs.

The comparison between these two PV is particularly relevant in contexts where local populations perceive fiscal policy as a “black box”, with the lack of well-established and

transparent monitoring mechanisms and reporting by public institutions. Ultimately, local populations' WTP for conservation purposes is context-specific, as the heterogeneity of the different environments matters, including cultural differences, gender, education, and institutions. In the face of a lack of trust in politicians and institutions, there may exist the fear that the "wrong people" would benefit.

The results from this study suggest a significant influence of the PV on the elicited WTP. A crowdfunding campaign seems a credible alternative for regulators to raise funds to preserve natural ecosystems. As our results show, these new practices may help overcome existing public institutions' reputational risks, which are, in general, associated with traditional funding sources. Importantly, this is the sole study of this kind in Portugal, and the estimated WTPs obtained will be useful to better inform decision-makers to support sustainable public policy decision-making. Moreover, it provides evidence supporting the claim that the choice of the PV is relevant to the specific context where it is applied.

The remainder of the paper is organized as follows. Section 2 presents the case study and the survey design. Section 3 describes the econometric model. Section 4 presents and discusses the results obtained, and finally, Sect. 5 offers conclusions. Ancillary tables are included in the Appendix.

## 2 Case study and data collection

The importance of the links between a healthy ecosystem and human well-being has become more evident in recent decades (TEEB, 2010). Coastal populations and many economic activities significantly depend on the goods and services provided by Marine and Coastal Ecosystem Services (MCES) (Magnussen et al. 2012), thus contributing to increased pressure on the natural environment. Typically, the most relevant direct threats to MCES are overfishing, pollution, habitat loss and degradation, and impacts on coastal dynamics (sea-level rise and erosion) (Millennium Ecosystem Assessment, 2005). Environmental hazards may also result from emerging activities such as offshore aquaculture, deep-sea mining, or offshore energy production. Moreover, coastal ecosystems have been identified as being particularly exposed to climate change's negative impacts. In this context, the UN Decade of Ocean Science for Sustainable Development 2021–2030 set a call for urgent action to conserve and sustainably use the oceans, seas, and marine resources for sustainable development.

MCES' vulnerability is aggravated in the presence of market and government failures. The absence of markets for many of the goods and services provided incorrectly suggests that the opportunity cost of degrading MCES is zero (or negligible), implying that current decision-making processes often ignore or underestimate the value of natural ecosystem benefits. Therefore, assessing their economic value for preservation purposes, for example, by estimating the population's willingness-to-pay (WTP) to prevent damages to or improve MCES quality, is key to better-informing policymakers (Magnussen et al. 2012).

We develop a study that elicits the Portuguese population WTP for additional preventive measures against eventual environmental hazards along the southwestern coast of Portugal (south of Lisbon). We conducted a discrete choice experiment (DCE) and applied the Total Economic Value (TEV) framework to identify use (surf or beach) and non-use values (biodiversity, coastal protection). The implementation of the preventive measures would require

a one-time payment for a 5-year program. In the crowdfunding version, contributions would be collected only once through a crowdfunding campaign, while in the tax version, they would be collected also once, through the yearly income tax in the first of the five years. The amount collected would be administered by the Portuguese Authority responsible for combating those accidents, their impacts, and research and development on prevention and mitigation of oil spill impacts: Directorate-General of Maritime Authority (DGAM). In the following subsections, we describe in more detail the case study and the data collection procedure.

## 2.1 Case study

The Portuguese coast is characterized by a diversity of natural environments. Due to its geographical location, characterized by a long (North) Atlantic shoreline at the intersection of some of the world's main maritime routes (North/South and East/West), those natural environments are subject to rising pressure due to the growth in tourism demand and the heavy maritime traffic in commercial ports and maritime corridors along the coast. This traffic has increased over the last decade, and its trend is rising. In the context of the transition to carbon neutrality by 2050, ports are gaining relevance by serving as platforms for multiple uses, a major one being to support the energy transition (HFW, 2021). To date, there are several records of hydrocarbon and/or hazardous and/or noxious substances (HC/HNS) accidental spills off the Portuguese coast, though information regarding their impact on Marine and Coastal Ecosystem Services (MCES) is scarce.<sup>1</sup> Given the rising trend in maritime traffic along the Portuguese coast, the frequency of accidents involving vessels and/or industrial facilities, such as ships cleaning out their bulk tanks, and HC/HNS spills may increase, implying increasing pressure on MCES. An eventual spill would produce significant ecological losses, given the natural heritage along the Portuguese coast including several protected areas (Frazão Santos et al. 2013).

The high risk of an oil spill occurring in the study area is introduced to simulate a significant change in the conditions of the natural environment, considering the damage that this would cause and the impact it would have on the MCES supply. The study site was identified as a location with a high risk of oil spills and high natural value (Sect. 2.2).

We address three main research questions in this study:

- What is the Portuguese population's WTP to prevent and mitigate oil spill damages on MCES at the selected site?
- Does the payment vehicle (either a mandatory income tax or a crowdfunding with provision point mechanism) in a stated preferences survey influence individual elicited WTP for preventing and mitigating oil spill damages on MCES at the selected site?
- Given the payment vehicle, how does the perception of the Portuguese population of the quality of institutions influence WTP elicitation for the proposed programs, and how can this be used to inform sustainable public policy decision-making?

<sup>1</sup>Accident with the oil tanker *Prestige* in Galicia and northern Portugal in 2002, oil spill in coastal Alentejo with the ship *Marão* in 1989, among others.

## 2.2 Selected Site

The study area includes the coastal area of the *Southwest Alentejo and Costa Vicentina Natural Park*, located on the southwest coast of Portugal, including the Marine Protected Area which is located 2 km from the coastline. This territory was classified as a protected area in 1988 and classified as a Natural Park in 1995 to protect its highly valuable biodiversity (ICNF, n.d.). The site contains a large diversity of coastal habitats, including cliffs, beaches, dunes, salt marshes, among others, and rich and diverse fauna and flora species. It also holds high social, economic, cultural, and leisure value thanks to several surfing hot spots, and beaches along the coast (Fig. 1). The coastline is not uniform from a geological perspective, which implies that benefits provided by the different natural ecosystems are also diverse along the coast.

On the other hand, the study area is also close to the port of Sines, which is Portugal's main entry point for oil and gas (currently, mostly liquefied), meaning that the area is at considerable risk of suffering from the adverse effects of hazardous spills. Previous oil spills have occurred in and close to the site, and the sea currents were responsible for the spreading of hazardous materials (Janeiro 2018).

## 2.3 Survey design

We conducted a DCE survey to elicit the WTP of the Portuguese population to prevent and mitigate oil spills along the southwestern coast of mainland Portugal, to protect the provision of four MCES. In the context of our study, protection means obtaining additional resources to acquire appropriate technical equipment and support training/skills upgrading

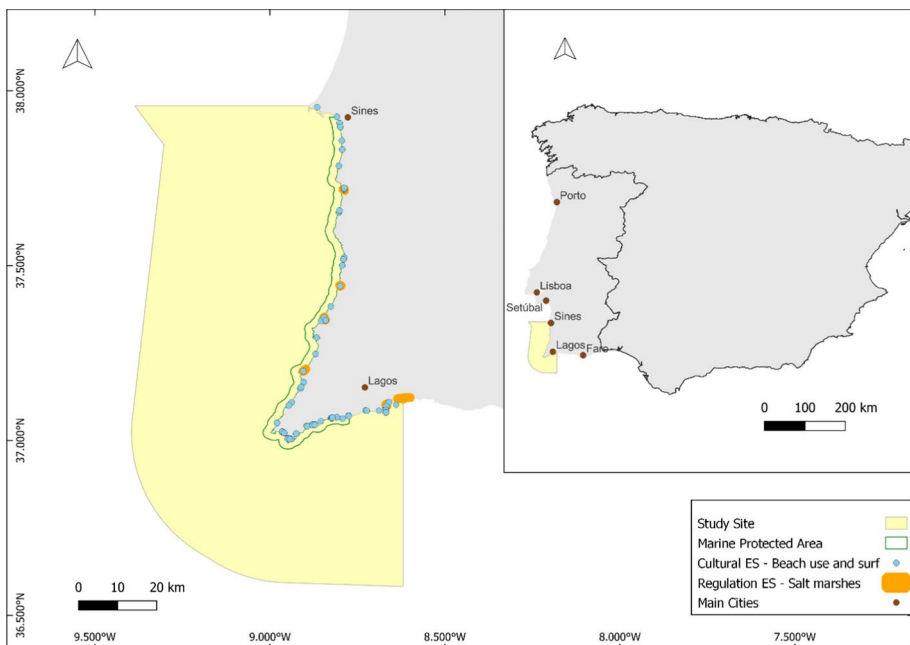


Fig. 1 Study site

of dedicated workers to improve their performance in preventing and mitigating potential hazards to reduce damages.

Respondents were informed through a video about the oil spill prevention and mitigation program that could be applied provided sufficient funds were collected. The program would be a combination of different measures presented below, and this justifies that the programs have different combinations of ES protection and different costs. This involves:

- The construction of an intermediate logistical base between Sines and Lagos, which includes a control post with combat equipment and an access ramp to the sea. Currently, this only exists in the ports of Sines and Lagos;
- Buying new cleaning equipment;
- The strengthening of coastal surveillance through helicopters and drones;
- The hiring and training of personnel, including conducting training exercises.

Given that funds are limited, the responsible authority must prioritize where to focus resources, including geographically. To ensure that respondents perceive their choices as policy consequential, all participants are presented with a commitment letter written by the responsible authority DGAM.

We followed a split-sample design to test for differences between two PVs, a mandatory income tax and crowdfunding. Since in Portugal around 50% of the population does not pay income tax because they are below the income threshold, we considered (and informed the respondents) that in these cases there would be an additional mandatory tax.

ES was introduced and explained as the benefits that humans obtain from the natural environment. The following four MCES were considered, with two levels each (more detailed description in the supplementary material):

- **Biodiversity conservation**– The study area has a high diversity of species and habitats, which would be endangered by a potential oil spill event.

- **Beach use**– The study area includes a coastline of more than 100 km (about 62.14 mi) long, with beaches all along the coast, which are used by local and tourist populations for nature activities and bathing. Oil spill events can cause the prohibition of access to beaches for different periods.

- **Coastal protection**– The study area includes four saltmarsh areas, which work as natural barriers against flood and sea storms. Oil spills affect the vegetation of these areas, which decreases their protection.

- **Surf**– The study area includes several internationally renowned surf spots, which attract visitors all year round. Oil spills restrict surfers' access to the affected areas.

A face-to-face survey was conducted at the national level, in all 18 districts of mainland Portugal. The survey was administered between September and December 2020 by a market research company to a representative sample of the Portuguese population concerning socio-economic characteristics and residence location, based on the data from Census 2011 (INE, 2011).

With four MCES attributes with two levels each (some level of protection or no additional protection) and one cost attribute (with five levels from 0 € to 125 €), we followed a D-efficient design to reduce possible attribute combinations, based on the priors obtained from the focus groups and pre-test survey conducted. The resulting design contained 24 choice sets, which were blocked into six distinct sets of four choice cards each. Thus, each respondent

was presented with one of these six sets and asked to make four choices with three alternatives each. One of the alternatives was always the SQ option, which is a no-cost option with no additional ES protection against oil spills, but rather the current state. Despite currently existing some protection measures, which are the responsibility of DGAM, they are limited in what concerns not only the quantity and quality of the available equipment but also the area that can be assessed for intervention in case a hazard occurs. The final survey was based on contributions from an interdisciplinary team of researchers, three focus groups, and a pre-test with 105 respondents. Two focus groups were held at Nova SBE in Lisbon, and one in the city of Sines. The pre-test was conducted by the same company as the final survey, following identical sampling procedures. The final survey was subject to ethical approval by the Scientific Council of Nova School of Business and Economics and the structure of the focus groups and survey materials are provided in supplementary documents.

The survey was structured as follows: after explaining its purpose and conditions, the first section contained a short personality test (Ten Item Personality Inventory).<sup>2</sup> The second section consisted of several questions related to the respondents' connection to the study site. Thirdly, each respondent was shown a video clarifying what is meant by each of the MCES considered, their role based on examples within the study area, the existing threat of potential oil spills, and explaining the valuation scenario, including the payment vehicle. A second short video was shown explaining the choice cards and how to choose the preferred option (choice card example in Fig. 2). Then, respondents were asked to make a series of four choices and to answer a set of follow-up questions on the choices made, including certainty regarding those choices made, and the motives to contribute or not to a prevention and mitigating program. This included budget constraint issues (affordability of the program), how the respondents perceive the quality of institutions (trust), the policy and payment consequentiality, scenario credibility, and fairness related to who should pay for the site preservation, either the local population, the polluting companies, or the population in general. Finally, the respondents were asked several sociodemographic questions, and others on their behavior/attitude towards the environment.

### 3 Econometric model

The theoretical background for analyzing discrete choice experiments is the random utility maximization model (McFadden et al., 1973). Underlying this method is the idea that respondents choose the alternative with the highest utility. Utility depends on observed attributes, entering the model as explanatory variables, and attributes that the analyst does not observe which are considered as random variables (McFadden et al., 1973). For individuals,  $n = 1, \dots, N$ , facing a choice between  $J$  alternatives,  $j = 1, \dots, J$  at  $T$  choice occasions,  $t = 1, \dots, T$ , the indirect utility function takes the following form:

$$U_{njt} = V_{njt} + \epsilon_{njt}, \quad (1)$$

where  $V_{njt}$  represents the deterministic part of utility, and  $\epsilon_{njt}$  stands for the stochastic part. An individual chooses alternative  $j$  if  $U_{njt} > U_{nit}, \forall j \neq i$ , maximizing utility conditional on observed characteristics and unobserved tastes. The deterministic component  $V_{njt}$  is

<sup>2</sup>This will be explored in further work.



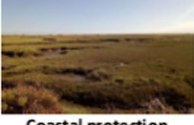

Ecosystem service	Level of protection		
	Program 1	Program 2	Status Quo
 Biodiversity conservation	Protects	Protects	No protection
 Beach use	Protects	No protection	No protection
 Coastal protection	Protects	Protects	No protection
 Surf	No protection	Protects	No protection
Cost	25 €	75 €	0 €
Choice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Fig. 2 Choice card example

assumed to be linear in its parameters. In this paper, the general specification of the utility function is similar to the one in Train and Weeks (2005) as stated below:

$$U_{njt} = -p_{njt}\alpha_n + \mathbf{X}_{njt}'\beta_n + \mathbf{Z}_{njt}'\gamma + \epsilon_{njt}. \tag{2}$$

where  $p_{njt}$  represents the cost attribute, and  $\mathbf{X}_{njt}$  and  $\mathbf{Z}_{njt}$  represent vectors of variables describing the observed attributes of goods or services of alternative  $j$  for individual  $n$  at choice occasion  $t$ . A dummy capturing the PV version (tax vs. crowdfunding) and the status quo alternative specific constant are included in the  $\mathbf{Z}$  vector. The cost coefficient  $\alpha_n$ , and the coefficients of the ES attributes  $\beta_n$  are individual-specific as we introduce heterogeneity through a mixed logit (MXL) specification, which accounts for the heterogeneity of preferences among respondents. The other coefficients  $\gamma$  are treated as homogenous, as is the case in standard multinomial logit (MNL) models. All interaction terms are included in

vector  $\mathbf{Z}$  as we treat them as shifting the mean of the environmental attribute, thus keeping the distribution constant. Equation (3) represents the model in preference-space. Willingness to pay for an attribute is obtained as the ratio of the attribute's coefficient to the price coefficient. As this study's goal is to estimate the WTP for the ES, it makes sense to incorporate this fact into the model directly. Specification (2) can be rearranged by dividing the non-monetary coefficients by the cost coefficient and adding a scale parameter  $k_n$ , as follows:

$$U_{njt} = \lambda_n [-p_{njt} + \mathbf{X}_{njt}'\boldsymbol{\omega}_n + \mathbf{Z}_{njt}'\boldsymbol{v}] + \varepsilon_{njt}, \quad (3)$$

where  $\lambda_n = \alpha_n/k_n$ ,  $\boldsymbol{\omega}_n = \beta_n\alpha_n$  and  $\boldsymbol{v} = \gamma/\alpha_n$ . Therefore, the vectors of parameters  $\boldsymbol{\omega}_n$  and  $\boldsymbol{v}$  in specification (3) are scale-free and directly interpretable as marginal WTP. Moreover, it is possible to define a distribution for these WTP directly instead of working with ratios of the underlying preference-space distributions, which often imposes unrealistic assumptions on the WTP distributions.<sup>3</sup> Therefore, the variation in WTP can be modelled independently of scale and distinguished from the variation in the cost coefficient, which incorporates scale. When the goal is to obtain WTP estimates for policy purposes, parametrization into WTP-space is the best option (Mariel et al. 2021). We estimate Eq. (3) which is in WTP-space through Maximum Simulated Likelihood (Revelt & Train 1998; Train 2009), using Carson & Czajkowski (2019)'s MATLAB package for discrete choice experiments.

## 4 Results

### 4.1 Data

We obtained 918 individual responses after removing incomplete answers. We identified protest bids as those who were systematically not willing to pay, that is, zero-bid protesters, except for those that were considered "true-zeros". The argument for this protest definition is that the estimated WTP in DCEs is a function of the various trade-offs among attributes (Louviere 2001; McFadden 2001) and if we understand a protest answer as "refusal to trade one attribute for another", we may assume that individuals who always choose the SQ option are avoiding disclosure of their true WTP (Louviere 2001). "True-zero" bids relate to respondents that systematically choose the SQ in all choice tasks, and that this choice is based on rational economic behavior consistent with budget constrained utility maximization. These were identified based on the answers to a follow-up question regarding budget constraint and are not considered protest bids.<sup>4</sup> Protest responses were removed, as they may not reveal respondents' true preferences and, therefore, bias the WTP results (Mariel et al. 2021). After removing protesters, we obtained 845 valid responses (410 for the tax version survey and 435 for the crowdfunding version).

Our sample matches the Portuguese adult population quite closely, only with the mean education level slightly above the national average (Appendix Table 5). For the analysis,

<sup>3</sup>An alternative approach would be to use the parameters obtained in preference-space in a Monte-Carlo simulation to obtain WTPs. However, research has shown that this method usually yields fatter distribution tails and less efficient estimates (Train and Weeks 2005; Scarpa, Thiene, and Train, 2008).

<sup>4</sup>As a robustness check, we have included in the Appendix (Tables 11, 12 and 13) the main model results including the whole sample without removing protest responses, and the results remain stable.

the variables *education* and *employment* were reduced from six to three, and from six to four categories, respectively, to avoid categories with low representation. The variable *coastal municipality* is a dummy variable about whether respondents lived in a municipality with a coastline at the time the survey was conducted. It was obtained from the four-digit postal codes elicited in the survey. The variable *environmental attitude* is a latent variable estimated by a structural equation model (SEM), using five questions on environmental behavior, each measured on a 3-point Likert scale, as observed variables. *Lack of trust in institutions*, *fairness concerns* and *disbelief in policy consequentiality* are dummy variables that cover a variety of possible attitudes. They are derived from responses to one or two 3-point Likert scale questions each.<sup>5</sup> Respondents are considered to have a negative perception if they select the most extreme option in both corresponding questions.

The last column of Table 1 presents the p-values for the statistical tests performed to test whether there is a statistically significant difference between the two sub-samples (t-test for a difference in means for the continuous variables and chi-square test of independence for the categorical variables.) As observed, there is a statistically significant difference between

**Table 1** Descriptive statistics

		Full sample (N=845)	Tax version sub-sample (N=410)	Crowd-funding sub-sample (N=435)	Difference between sub-samples
<i>Gender (% Male)</i>		45.21%	44.15%	46.21%	$p=0.274$
<i>Age</i>	Min	18	18	18	$p=0.477$
	Max	91	88	91	
	Mean	47.8	47.74	47.81	
<i>Education</i>	None or Basic	60.24%	59.27%	61.15%	$p=0.684$
	Secondary or professional	21.89%	23.17%	20.69%	
	Higher education	17.87%	17.56%	18.16%	
<i>Employment</i>	Employed	54.44%	50.49%	58.16%	$p=0.073$
	Retired or on reserve	22.01%	22.44%	21.61%	
	Unemployed	17.40%	20.49%	14.48%	
	Student	6.15%	6.59%	5.75%	
<i>Coastal municipality (% Yes)</i>		56.80%	58.54%	55.17%	$p=0.162$
<i>Lack of trust in institutions (% Yes)</i>		12.31%	8.78%	15.63%	$p=0.001$
<i>Fairness concerns (% Yes)</i>		22.37%	23.90%	20.92%	$p=0.150$
<i>Disbelief in policy consequentiality (% Yes)</i>		15.86%	13.17%	18.39%	$p=0.019$
<i>Lack of trust in institutions or Disbelief in policy consequentiality (% Yes)</i>		22.01%	19.27%	24.60%	$p=0.031$
<i>Environmental attitude (standardized)</i>	Mean	0.0143	0.0421	-0.0119	$p=0.431$

The last column covers the p-values for t-tests and Chi-Square tests, respectively

<sup>5</sup> *Lack of trust in institutions*: “The contributions/taxes collected for the program will be exclusively used for its implementation” and “This type of programs should be covered by already existing taxes”; *Fairness concerns*: “The cost of these programs should be beared by residents and visitors of the area” and “The costs of these programs should be bared by the oil companies and/or shipping agents”; *Belief in policy consequentiality*: “My answers will influence the implementation of the program”.

the two sub-samples on the variable *employment* only at the 10% significance level. There are slightly more employed respondents in the crowdfunding version than in the tax version. This small difference is due to random chance, as respondents were randomly selected across sub-samples. More importantly, the proportion of individuals who have a *lack of trust in institutions* and *disbelief in policy consequentiality* is larger in the crowdfunding sub-sample. The differences are significant at 1% and 5%, respectively, despite their small magnitude (roughly 6 p.p.). Since these attitudinal questions were asked after the choice experiment of the survey, it seems that there was an influence of the PV on these elicited attitudes. However, an advantage of having the attitudinal questions about the role of institutions being asked after the choice experiment, is that we avoid that they influence respondents' choices and consequently the elicited WTP. For all other variables included in the final model, there is no statistically significant difference across sub-samples.

### 4.2 Data analysis

As this study is, to the best of our knowledge, the first on MCES valuation using stated preferences methods for a representative sample of the Portuguese population, we first provide baseline WTP estimates for the combined sample. The estimated status quo constant represents a threshold value that the gain of some alternative must exceed to be selected and our results show that respondents in the DCE chose some sort of protection program in 52% of the choice occasions. Table 2 presents the estimated coefficients from the MXL and the MNL specifications. For the MXL, we assume that all ES attribute parameters are normally distributed, the cost parameter is log-normally distributed to ensure that it enters the random utility function negatively and is non-zero, and the status quo coefficient is assumed to be fixed. Moreover, we assume uncorrelated WTPs. We note that in this model coefficients in preference-space may be correlated due to the randomness of the price coefficient, capturing the randomness in the scale parameter, which is a realistic assumption given the panel and split sample structure of the data.

The goodness-of-fit measures show that the MXL specification fits the data better than the MNL specification. This and the fact that all standard deviations are highly significant

**Table 2** Baseline model results

	MNL	MXL	
	Coefficient (SE)	Coefficient (SE)	Std. Dev (SE)
<i>Status quo</i>	75.58*** (8.56)	63.69*** (6.28)	0 (n/a)
<i>Biodiversity</i>	68.67*** (5.41)	55.05*** (6.70)	116.00*** (7.86)
<i>Beach</i>	47.76*** (4.67)	41.50*** (5.93)	82.69*** (5.77)
<i>Coast</i>	19.78*** (4.64)	36.08*** (5.57)	61.58*** (5.59)
<i>Surf</i>	-8.00* (4.67)	-5.22 (5.26)	53.01*** (5.32)
<i>-Cost (in preference space)</i>	0.01*** (0.01)	0.46*** (0.42)	2.14*** (0.42)
<i>N</i>	845	845	845

MNL:  
LogLikelihood=-3234.09,  
AIC/n=1.92, McFadden's  
Pseudo-R<sup>2</sup>=0.09

MXL:  
LogLikelihood=-2584.07,  
AIC/n=1.54, McFadden's  
Pseudo-R<sup>2</sup>=0.27

WTP in Euros with  
significances: \**p*<0.1;  
\*\**p*<0.05; \*\*\**p*<0.01

MNL and MXL models are  
estimated in WTP space

suggest strong heterogeneity of preferences. As the model is estimated in WTP-space all coefficients can be interpreted as marginal WTP values (Euro). In the context of this study, all attributes enter as dummy variables for either protecting the ES or not. Therefore, WTP estimates show how much the Portuguese population is willing to pay to provide some level of protection in comparison to no change in protection in the status quo. Except for surfing, all ES attributes show a significant positive WTP. Biodiversity protection has the highest mean WTP with ca. 55€. In combination with the estimated standard deviation, the underlying population distribution suggests that over 68% of the Portuguese population have a positive WTP for this MCES. Based on the assumption that the WTPs for the environmental attributes are normally distributed, the estimated mean and standard deviation can be used to derive the underlying distribution and elicit which share of that distribution is above zero, obtaining a measure for the positive WTP rate. Beach protection has the second highest mean WTP at roughly 41€, and a positive WTP for over 69% of the sample. Among the significant attributes' coefficients, the lowest mean WTP is associated to the coastal protection ES, with ca. 36€. However, it is the attribute with the highest positive WTP rate, over 72%. The mean WTP for surfing protection is not statistically significant. Our findings suggest a total economic value (TEV) of ca. 350.66 million euros 2020 for the 5-year program. This number is derived as the product of the individual WTP of 42.25€ and the total adult population of mainland Portugal, which was 8,299,575 in 2020 (INE, 2024).<sup>6</sup> The mean WTP for surfing protection is not statistically significant, meaning that, on average, the Portuguese population does not seem to be willing to contribute to the protection of surf. A possible interpretation of these results is that the non-use values related to maritime ES are valued higher than their use-values as the combined WTP for biodiversity conservation and coastal protection is 91€, that is, more than twice the use value counterpart (41€). Revealed preferences as travel cost methods could most likely offer a better approach to estimating the use value of the surfing activity.<sup>7</sup>

The constant (non-random) coefficient of the status quo is positive and statistically significant. This means that some respondents elicit the status quo option even when presented with alternatives that involve protecting the natural ecosystem from hazards. This constant may represent a bias that has been associated in other studies to respondents' protest attitudes related to the payment of the hypothetical good. One problematic consequence is the possible underestimation of real WTP values. To analyze this, we test whether the bias relates to the PV in the subsequent estimations. We also examine whether respondents' perceptions of institutions vary with different PVs.

To investigate whether the choice of the PV in the valuation scenario makes a difference when assessing the economic value of MCES, the model specification in Table 3 includes an interaction term between the status quo and the dummy variable *tax version* (takes the value 1 in the case of the tax version and 0 in the crowdfunding version). This interaction term is positive and statistically significant, meaning that respondents in the subsample

<sup>6</sup>As a simple summation of coefficients is infeasible for mixed logit models, the individual WTP is obtained by taking 1,000,000 random draws of the underlying distributions, summing them for each draw, and taking the median of the resulting distribution.

<sup>7</sup>We thank an anonymous referee for this comment.

**Table 3** Results for model interacting with payment vehicle variable

	MNL	MXL	
	Coefficient (SE)	Coefficient (SE)	Std. Dev (SE)
<i>Status quo</i>	58.89*** (8.52)	45.96*** (6.30)	0 (n/a)
<i>Status quo * tax version</i>	34.68*** (5.39)	44.05*** (6.07)	0 (n/a)
<i>Biodiversity</i>	68.86*** (5.40)	55.74*** (6.12)	111.20*** (7.39)
<i>Beach</i>	47.93*** (4.66)	41.53*** (5.75)	82.86*** (5.58)
<i>Coast</i>	19.94*** (4.63)	36.15*** (5.31)	62.60*** (5.31)
<i>Surf</i>	-7.63 (4.65)	-5.92 (5.32)	59.39*** (5.15)
<i>-Cost (in preference space)</i>	0.01*** (0.01)	1.30*** (0.55)	1.77*** (0.52)
<i>N</i>	845	845	845

MNL:

LogLikelihood=-3211.37,  
AIC/n=1.90, McFadden's  
pseudo-R<sup>2</sup>=0.09

MXL:

LogLikelihood=-2564.26,  
AIC/n=1.52, McFadden's  
pseudo-R<sup>2</sup>=0.28

WTP in Euros with  
significances: \* $p < 0.1$ ;  
\*\* $p < 0.05$ ; \*\*\* $p < 0.01$

MNL and MXL models are  
estimated in WTP space

contributing through an additional mandatory income tax increase their preference for the status quo by ca. 44€.<sup>8</sup>

Moreover, the means and standard deviations of the WTPs for the MCES remain relatively stable when this interaction term is included. These results are in line with Sanches et al. (2019), where the use of a tax PV is related to respondents eliciting lower WTPs or more often choosing the status quo. This will be examined in more detail below.

To check for the robustness of our results and to measure the effects of socioeconomic characteristics on elicited WTP, we estimate a model containing interactions, as in Table 5 in the Appendix. The results show that, most importantly, the *tax version* coefficient seems to be robust to the inclusion of further respondents' characteristics as it is similar in magnitude and remains statistically significant. The results also show that all else equal, individuals who score higher on the *environmental attitude* variable are more willing to support environmental protection than those who score lower.

Interaction terms concerning occupation suggest that, on average, unemployed respondents have a considerably higher preference for the SQ compared to employed ones, which are the baseline in this estimation. Retired respondents also have a slightly higher preference for the SQ. However, this coefficient is only significant at 10%. These results are as expected since these groups are typically associated with lower disposable income. On the other hand, students' preference for the SQ does not differ from that of employed respondents, all else equal.

Moreover, there is evidence that preference for SQ decreases with education. Both secondary education and higher education show negative coefficients that are highly significant. In comparison to respondents who have no or only basic education, those with secondary or higher education show a higher preference to pay for preventive and mitigating measures rather than maintaining the SQ with no additional cost.

<sup>8</sup>The treatment of all status quo (SQ) interaction terms as preferences is justified by recognizing the SQ coefficient as a representation of relative preference for the current state over proposed alternatives. It is the magnitude rather than the exact €-values themselves that is interesting for interpretation.

We find no significant difference in the preference for choosing the SQ over any preventive and mitigating measure for *coastal municipality* or *age*. However, respondents living in a coastal municipality seem to have a ca. 29€ higher WTP for biodiversity conservation. Furthermore, the results suggest that age influences WTP for certain MCES. All else equal, we find that the WTP for biodiversity conservation and protection of surfing sites declines with age.

To further explore what may be driving the results regarding the influence of the PV we constructed three binary variables aiming at eliciting respondents' perceptions regarding the quality of institutions and use of tax money, policy consequentiality, and fairness concerns regarding the programs presented. These variables were derived based on the answers given to a set of follow-up questions as described in Sect. 2. In turn, we include additional interaction terms of these variables with both the SQ and the PV dummies. The final model results are presented in Table 4. Again, note that the PV interaction term and the MCES attributes' WTPs are robust to the inclusion of these additional interaction terms.

From the results in Table 4, we observe the following. As in the previous model, there is a tendency for respondents to prefer the SQ option with a value of 35€ for the *crowdfunding*

**Table 4** Final model results when controlling for PV and follow-up questions (*lack of trust in institutions, fairness concern, and disbelief in policy consequentiality*)

	MNL	MXL	
	Coefficient (SE)	Coefficient (SE)	Std. Dev. (SE)
<i>Status quo</i>	43.31*** (8.83)	35.49*** (6.50)	0 (n/a)
<i>Status quo * tax version</i>	46.76*** (6.81)	52.11*** (7.54)	0 (n/a)
<i>Status quo * lack of trust in institutions</i>	40.55*** (11.46)	33.55** (13.40)	0 (n/a)
<i>Status quo * fairness concerns</i>	17.75** (9.03)	17.95** (7.56)	0 (n/a)
<i>Status quo * disbelief in policy consequentiality</i>	30.85*** (10.69)	19.45* (11.57)	0 (n/a)
<i>Status quo * tax version * lack of trust in institutions</i>	-45.42*** (17.29)	-26.96 (21.53)	0 (n/a)
<i>Status quo * tax version * fairness concerns</i>	-2.15 (12.43)	-1.46 (12.97)	0 (n/a)
<i>Status quo * tax version * disbelief in policy consequentiality</i>	-25.62* (15.18)	-12.01 (19.20)	0 (n/a)
<i>Biodiversity</i>	68.85*** (5.42)	57.26*** (5.63)	109.16*** (6.75)
<i>Beach</i>	48.18*** (4.69)	43.16*** (5.28)	83.22*** (5.11)
<i>Coast</i>	20.34*** (4.67)	35.69*** (5.27)	62.80*** (4.87)
<i>Surf</i>	-7.57 (4.68)	-5.50 (5.18)	56.35*** (5.63)
<i>-Cost (in preference space)</i>	0.01*** (0.01)	3.59** (0.66)	67.97*** (0.63)
<i>N</i>	845	845	845

MNL:  
LogLikelihood=-3189.36,  
AIC/n=1.89, McFadden's  
pseudo-R<sup>2</sup>=0.14

MXL:  
LogLikelihood=-2555.22,  
AIC/n=1.52, McFadden's  
pseudo-R<sup>2</sup>=0.31

WTP in Euros with  
significances: \* $p < 0.1$ ;  
\*\* $p < 0.05$ ; \*\*\* $p < 0.01$

MNL and MXL models are  
estimated in WTP space

version. The preference for the SQ becomes stronger when the respondent is offered the *tax version*, reaching a value of 88€ (35.49€+52.11€).

Respondents who express a *lack of trust in institutions* have a stronger preference for the SQ. For the respondents that were presented with the *crowdfunding version*, the preference for the SQ increases to 69€ (35.49+33.55). With the *tax version*, the value increases to 94€ (35.49+33.55+52.11–26.96). Similar results are obtained when calculating the preference for the SQ for the individuals who expressed *disbelief in policy consequentiality* or *fairness issues*: the preference for the SQ is always lower with the *crowdfunding version*. As robustness checks, we have estimated the model separately for the two PV subsamples but keeping the interaction terms between the status quo and the attitudinal variables. In both cases we obtained consistent results for the PV effect (Tables 9 and 10).

The fact that respondents with negative perceptions on the quality of institutions (*lack of trust in institutions* and *disbelief in policy consequentiality*) are more prone to elicit the status quo option, instead of alternatives involving the protection of positively valued ES, represents a bias that leads to an underestimation of the WTP for environmental protection. This result is particularly relevant for Portugal, as recent evidence from Worldwide Governance Indicators (World Bank, 2024, Fig. 3 in the Appendix) and additional sources shows that distrust in government and public institutions have increased in the last five years.<sup>9</sup> As taxes represent a significant burden in Portugal, extra taxes are not welcome. This may explain why in the tax version the preference for the SQ is higher than in the crowdfunding.

Finally, we have also checked whether the three attitude indicators are associated with the WTP for any of the four MCES besides the general aversion to pay for any sort of program. The results are presented in Appendix Table 6. No statistical significance was found in any of the twelve interaction terms, except for (*coastal protection \* disbelief in policy consequentiality*) which is only marginally significant at 10%. Therefore, we conclude that the preference for the status quo concerns the payment for conservation programs in general and not for any specific ES.

### 4.3 Limitations

In this section, we acknowledge some limitations of our study.<sup>10</sup> Since this is a pioneer study in Portugal, there are several challenges that we had to face. Because there are no similar studies that estimate the WTP for the preservation of natural ecosystems in this context, we cannot make any comparisons to assess for external validity. Therefore, our results should be regarded as exploratory. Further studies are needed to investigate alternative funding sources, like crowdfunding, for the preservation of natural ecosystems.

Following a rigorous survey design procedure, including the development of focus groups and pilot surveys, the final version of the survey was simplified to avoid cognitive bias and respondent fatigue. This involved a simplification of the follow-up questions to a 3-point Likert scale and considering only two levels of protection in the choice experiment

<sup>9</sup>According to the Director of Transparency Portugal 2022 (Nuno Cunha Rolo), “In line with previous results, the national results of the Perception of Corruption Index for Portugal in 2022 reflect a very timid and stagnated corruption combat, in which the perceived risk levels are aggravated by corruption, as well as a lack of transparency and control in the defense and national security sectors”. <https://transparencia.pt/indice-de-percecao-da-corrupcao-2022>.

<sup>10</sup>We thank an anonymous reviewer for suggesting the inclusion of this section.

(protect or not protect). However, these decisions regarding the study design also limited the ability to conduct some additional analyses. First, the content of our set of follow-up questions does not appear to provide sufficient information to allow the estimation of a latent variable model capturing the "lack of trust in institutions" as a latent variable. In general, it is problematic to estimate latent variable models with only two measurement variables, as more variables are typically used. In fact, to estimate this model, a variety of different optimization algorithms and model constraints were tried without success. For that reason, we had to follow a more direct approach, only considering respondents to have a lack of trust in institutions when they select the most extreme response options in the corresponding attitudinal questions. A similar approach was followed for fairness concerns and disbelief in policy consequentiality. Second, since the choice experiment presented only two possible levels of protection, it was not possible to implement a scope test. Dugstad et al. (2021) define that "Sensitivity to scope in nonmarket valuation refers to the property that people are willing to pay more for a higher quality or quantity of a nonmarket public good". To assess the economic significance of sensitivity to scope requires estimating the scope elasticity of WTP which requires more than two protection levels. However, this is not the case in our study. In any case, in DCEs the scope test "has often drawn less attention as the attributes vary and thereby internal scope sensitivity is ensured" (Mariel et al. 2021).

Lastly, one can argue that the protest definition that was adopted in this study is oversimplified, as we consider "protest-zeros" all respondents that consistently choose the status quo, except for those with budget constraints issues ("true-zero"). We acknowledge that there is no unique definition of protesters and past studies have adopted different definitions. Some definitions will identify too many and some will identify too few.

## 5 Conclusion

This study contributes to the literature on the economic valuation of ecosystem services in Portugal, being the first to estimate for a representative sample of the Portuguese population the WTP for protecting marine and coastal ecosystem services from hazards along the southwest and south Portuguese coasts.

We implement a DCE to a split sample to assess the effect of two PVs on WTP for environmental protection: a mandatory extra income tax and a crowdfunding campaign with a provision point mechanism. We find that respondents who were faced with the tax version were less prone to pay for prevention and mitigation than those who were confronted with a crowdfunding campaign. Therefore, our results suggest that crowdfunding is an interesting alternative vehicle to be explored by the public sector to raise funds to protect natural ecosystems, even in less credible institutional contexts, as is the case in Portugal.

Our results also show that, regardless of the payment vehicle, respondents who distrust institutions, do not perceive policy consequentiality, or have fairness issues related to the scenario presented are more likely to choose the status quo. As mentioned before, there is recent evidence in Portugal showing the poor performance of the country based on several governance indicators, such as The World Bank (Fig. 1 in the Appendix).

This may explain why respondents are more willing to contribute to the prevention and mitigation program through the crowdfunding campaign, as by ring-fencing the investment

to the exact purpose there is less possibility to use that money for other purposes, which increases transparency.

The preliminary evidence obtained in this paper also highlights the role that the selection of the payment vehicle can play as a source of funding to invest in innovation, namely in the context of climate change. Douenne and Fabre (2022) investigate how beliefs regarding a policy form (carbon tax with dividend policy) determine attitudes towards it by distinguishing between beliefs from the pure effects of preferences for the French population during the Yellow Vests crisis. Pessimism is often related to government distrust (Alesina et al. 2018). Since this may jeopardize local populations' support for climate action, it is relevant to better understand its causes and how it can be overcome. In the context of oil spill prevention and mitigation, our results can help decision-makers to assess trade-offs concerning different management options (e.g., prevention or restoration), to identify priority areas of intervention (e.g., for cleaning-up), or to decide on the appropriate amount of compensation to injured parties when liability is at stake, also allowing for implementing cost–benefit analyses, among other.

As crowdfunding becomes more popular due to the increasing use of technological platforms in daily life, and the success obtained in several different campaigns in Portugal (health, cultural, and innovation projects among others), this type of payment mechanism may become an important tool to be considered in future environmental valuation studies. There are a few examples of crowdfunding campaigns as a payment mechanism creating quasi-markets for environmental conservation, where consumers can purchase real improvements in environmental quality: In the Netherlands, the Voor je Buurt Foundation operates at the forefront of civic crowdfunding initiatives, empowering local communities to move forward with their projects. Specifically, the Crowdfunding for Nature program has raised over 1 million Euros and successfully funded over 100 campaigns for environmental improvement in the urban context (Crowdfunding Voor Natuur, n.d.). The Ocean Cleanup, also a Dutch initiative, is a notable large-scale environmental crowdfunding campaign. It has raised millions of euros to develop technologies for removing plastic from the oceans, attracting significant support across Europe (The Ocean Cleanup, n.d.). In the UK, the campaign "It's Time to Take Legal Action Against HS2" aimed to challenge the HS2 rail project due to its environmental impact. It sought to raise funds for legal action to protect ancient woodlands and wildlife habitats and the campaign successfully raised £140,665 to support this cause (CrowdJustice, n.d.).

To the best of our knowledge, this is the first study to address the potential role of crowdfunding as a tool for funding conservation of natural ecosystems at a large scale in Portugal. Better informed local populations are more motivated to defend their natural environment as they realize how valuable that is for their wellbeing in the present and in the future. Recent examples exist in Portugal where the engagement of the local communities was key to prevent interventions that could potentially damage the natural environment: in the case of lithium mining in the north of Portugal in a pristine rural environment, the opposition of the local populations prevented the investment from moving forward. Another example back to 2017 concerned the licensing granted by the regulatory authorities to private firms to search for fossil fuels offshore in the southwestern and southern coasts of mainland Portugal. Again, the opposition of civil society played a critical role in stopping the licensing. The increasing awareness of local populations about the importance of preserving the natural environment in the transition to carbon neutrality highlights the “confrontation” between a

top-down strategy risking institutions' reputational loss (associated to the tax version) vis à vis a bottom-up strategy fueled by the increasing engagement of local communities in natural capital conservation (associated to crowdfunding). A full understanding of these dynamics requires more research, namely by comparing them under different socio-economic and political contexts. As the empowerment of local populations becomes more effective, they get more involved which suggests that crowdfunding mechanisms may become more relevant. This favors crowdfunding, which may become more and more attractive, to the extent that it helps overcome local institutional, cultural or other "barriers" contributing to increase the welfare of local populations. Given the diverse set of economic, social, and political factors involved, and the interest of populations to contribute to environmental conservation and protection, a distinct line of research on this topic could provide meaningful insights.

As previous studies have shown, the payment vehicle plays an important role in the economic valuation of environmental goods. However, more research is still needed to understand the potential of crowdfunding as a tool for financing the conservation of public goods, such as local ecosystem services across space and different cultural contexts. Future work could investigate how the choice design and framing (e.g., the ordering of the attitudinal questions) in conjunction with the payment vehicle may influence the elicited individual WTP for conservation purposes. Investigating how to better "match" the payment vehicle with preservation goals in the short/medium run can also be an interesting research line to further pursue. Currently, looking for more "credible" alternative payment vehicles than traditional funding sources is even more important as the transition to carbon neutrality cannot be successful without the support of local populations.

## Appendix

See Tables 5, 6, 7, 8, 9, 10, 11, 12, 12 and Fig. 3.

**Table 5** Characteristics of the Portuguese population

<b>Gender</b>	
Male	47.8%
Female	52.2%
<b>Adult education level</b>	
None or basic	69.5%
Secondary or professional	16.7%
Higher education	13.8%
<b>Age of adult population</b>	
18–29	16.8%
30–39	18.4%
40–49	18.0%
50–59	16.3%
60–69	13.5%
70 or higher	16.9%
Median	47
<b>Active adult population</b>	
Employed and unemployed	73.4%
Non-active (retired, on reserve, other)	26.6%

Source: INE—Recenseamentos Gerais da População, 2011

**Table 6** Results for model including socio-economic variables interactions

	MNL	MXL	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
<i>Status quo</i>	87.3*** (26.95)	84.36*** (22.17)	0 (n/a)
<i>Status quo * tax version</i>	37.12*** (5.49)	46.52*** (6.4)	0 (n/a)
<i>Status quo * environmental attitude</i>	-20.04*** (3.03)	-19.6*** (3.32)	0 (n/a)
<i>Status quo * retired</i>	17.57** (8.78)	12.13 (10.07)	0 (n/a)
<i>Status quo * unemployed</i>	42.82*** (7.3)	40.87*** (8.67)	0 (n/a)
<i>Status quo * student</i>	9.12 (11.89)	10.73 (13.08)	0 (n/a)
<i>Status quo * secondary education</i>	-34.45*** (7.26)	-39.52*** (7.88)	0 (n/a)
<i>Status quo * higher education</i>	-47.08*** (8.23)	-37.58*** (8.99)	0 (n/a)
<i>Status quo * coastal municipality (incl. Lisbon)</i>	-4.05 (15.46)	-10.79 (11.33)	0 (n/a)
<i>Status quo * age</i>	-0.51 (0.49)	-0.68* (0.41)	0 (n/a)
<i>Biodiversity</i>	88.27*** (15.54)	98.11*** (19.48)	98.65*** (6.88)
<i>Beach</i>	53.34*** (14.46)	55.14*** (15.92)	78.03*** (5.5)
<i>Coast</i>	26.48* (14.64)	47.74*** (15.43)	59.7*** (5.48)
<i>Surf</i>	26.03* (14.53)	28.87** (14.45)	48.76*** (5.25)
<i>Biodiversity * coastal municipality (incl. Lisbon)</i>	28.86*** (9.81)	35.4*** (12.21)	0 (n/a)
<i>Beach * coastal municipality (incl. Lisbon)</i>	15.06 (9.33)	16.86 (10.83)	0 (n/a)
<i>Coast * coastal municipality (incl. Lisbon)</i>	9.78 (9.27)	13.04 (10.05)	0 (n/a)
<i>Surf * coastal municipality (incl. Lisbon)</i>	-3.74 (9.33)	-8.92 (9.05)	0 (n/a)
<i>Biodiversity * age</i>	-0.8*** (0.28)	-1.25*** (0.36)	0 (n/a)
<i>Beach * age</i>	-0.27 (0.27)	-0.48 (0.31)	0 (n/a)
<i>Coast * age</i>	-0.21 (0.27)	-0.47 (0.3)	0 (n/a)
<i>Surf * age</i>	-0.59** (0.27)	-0.6** (0.28)	0 (n/a)
<i>-Cost (in preference space)</i>	0.01***	0.31***	1.08***

**Table 6** (continued)

	MNL	MXL	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
	(0)	(0.34)	(0.33)
<i>N</i>	845	845	845

MNL: LogLikelihood = -3023.20, AIC/n = 1.80, McFadden's pseudo-R<sup>2</sup> = 0.19

MXL: LogLikelihood = -2472.07, AIC/n = 1.48, McFadden's pseudo-R<sup>2</sup> = 0.33

WTP in Euros with significances: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

**Table 7** Results when controlling for PV and follow-up questions, interacting with attribute variables

	MNL	MXL	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
<i>Status quo</i>	56.95*** (8.57)	42.11*** (6.21)	0 (n/a)
<i>Status quo * tax version</i>	37.31*** (5.48)	49.55*** (6.22)	0 (n/a)
<i>Biodiversity</i>	74.07*** (6.15)	64.83*** (7.35)	109.05*** (6.91)
<i>Biodiversity * protesting institutions</i>	-9.62 (12.05)	-17.15 (20)	0 (n/a)
<i>Biodiversity * fairness concerns</i>	-9.48 (8.59)	-15.36 (12.87)	0 (n/a)
<i>Biodiversity * disbelief in policy consequentiality</i>	-14.3 (10.34)	-16.34 (15.93)	0 (n/a)
<i>Beach</i>	50.9*** (5.3)	44.26*** (6.37)	82.26*** (5.58)
<i>Beach * protesting institutions</i>	-8.67 (11.09)	-13.69 (16.27)	0 (n/a)
<i>Beach * fairness concerns</i>	-5.46 (8.28)	-5.17 (10.61)	0 (n/a)
<i>Beach * disbelief in policy consequentiality</i>	-4.96 (9.79)	-7.54 (14.06)	0 (n/a)
<i>Coast</i>	25.84*** (5.39)	39.34*** (6.32)	62.12*** (5.63)
<i>Coast * protesting institutions</i>	-22.03* (12.24)	-15.08 (14.8)	0 (n/a)
<i>Coast * fairness concerns</i>	-5.64 (8.85)	-0.77 (10.5)	0 (n/a)
<i>Coast * disbelief in policy consequentiality</i>	-13.75 (10.45)	-23.53* (12.38)	0 (n/a)
<i>Surf</i>	-8.47 (5.46)	-6.3 (5.82)	56.28*** (5.26)
<i>Surf * protesting institutions</i>	-6.24 (13.15)	-11.41 (15.97)	0 (n/a)
<i>Surf * fairness concerns</i>	5.23 (9.78)	1.5 (10.24)	0 (n/a)
<i>Surf * disbelief in policy consequentiality</i>	0.86 (11.45)	4.56 (13.62)	0 (n/a)
<i>-Cost (in preference space)</i>	0.01*** (0)	2.31*** (0.58)	32.61*** (0.56)
<i>N</i>	845	845	845

MNL: LogLikelihood = -3194.07, AIC/n = 1.90, McFadden's pseudo-R<sup>2</sup> = 0.14MXL: LogLikelihood = -2552.82, AIC/n = 1.52, McFadden's pseudo-R<sup>2</sup> = 0.31WTP in Euros with significances: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

**Table 8** Results for interaction of the payment vehicle with the different attributes

	MNL	MXL	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
<i>Status quo</i>	75.06*** (8.53)	65.08*** (6.15)	0 (n/a)
<i>Biodiversity</i>	74.15*** (6.25)	63.65*** (7.96)	110.85*** (7.39)
<i>Biodiversity * tax version</i>	-11.91* (7.03)	-17.71 (11.07)	0 (n/a)
<i>Beach</i>	57.15*** (5.62)	48.78*** (6.97)	82.89*** (5.53)
<i>Beach * tax version</i>	-19.79*** (6.81)	-17.37* (9.12)	0 (n/a)
<i>Coast</i>	25.84*** (5.79)	44.02*** (6.7)	58.85*** (5.25)
<i>Coast * tax version</i>	-12.42* (7.23)	-16.26** (7.92)	0 (n/a)
<i>Surf</i>	-7.93 (5.98)	-6.87 (6.22)	57.39*** (5.18)
<i>Surf * tax version</i>	0.58 (7.94)	-0.35 (7.73)	0 (n/a)
<i>-Cost (in preference space)</i>	0.01*** (0)	1.03*** (0.53)	8.21*** (0.52)
<i>N</i>	845	845	845

MNL: LogLikelihood = -3217.53, AIC/n = 1.91, McFadden's pseudo-R<sup>2</sup> = 0.13  
 MXL: LogLikelihood = -2577.39, AIC/n = 1.53, McFadden's pseudo-R<sup>2</sup> = 0.31  
 WTP in Euros with significances: \**p* < 0.1; \*\**p* < 0.05; \*\*\**p* < 0.01

**Table 9** Results for interaction with follow-up questions (*lack of trust in institutions, fairness concern, and disbelief in policy consequentiality*) for the tax version subsample

	MNL	MXL	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
<i>Status quo</i>	134.33*** (18.3)	108.29*** (12.4)	0 (n/a)
<i>Status quo * protesting institutions</i>	-5.93 (15.18)	10.18 (21.3)	0 (n/a)
<i>Status quo * fairness concerns</i>	18.27* (10.28)	18.59** (9.16)	0 (n/a)
<i>Status quo * disbelief in policy consequentiality</i>	6.41 (12.8)	19.01 (13.75)	0 (n/a)
<i>Biodiversity</i>	92.83*** (10.96)	68.54*** (9.68)	139.28*** (11.77)
<i>Beach</i>	58.8*** (8.33)	55.34*** (6.82)	83.37*** (6.64)
<i>Coast</i>	33.38*** (8.31)	51.6*** (6.69)	67.96*** (6.41)
<i>Surf</i>	6.35 (7.96)	5.93 (7.16)	61.19*** (6.13)
<i>-Cost (in preference space)</i>	0.01*** (0)	8.21* (0.91)	378.65*** (0.94)
<i>N</i>	410	410	410

MNL: LogLikelihood = -1525.80, AIC/n = 1.87, McFadden's pseudo-R<sup>2</sup> = 0.15

MXL: LogLikelihood = -1230.72, AIC/n = 1.52, McFadden's pseudo-R<sup>2</sup> = 0.32

WTP in Euros with significances: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

**Table 10** Results for interaction with follow-up questions (*lack of trust in institutions, fairness concern, and disbelief in policy consequentiality*) for the crowdfunding subsample

	<b>MNL</b>	<b>MXL</b>	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
<i>Status quo</i>	20.36** (9.55)	5.05 (6.94)	0 (n/a)
<i>Status quo * protesting institutions</i>	35.62*** (10.19)	18.7** (9.43)	0 (n/a)
<i>Status quo * fairness concerns</i>	15.76** (8)	8.42 (7.84)	0 (n/a)
<i>Status quo * disbelief in policy consequentiality</i>	27.25*** (9.55)	21.76** (9.57)	0 (n/a)
<i>Biodiversity</i>	53.92*** (5.93)	42.95*** (7.58)	92.54*** (8.55)
<i>Beach</i>	41.84*** (5.62)	30.77*** (7.53)	75.36*** (7.35)
<i>Coast</i>	10.91* (5.63)	17.69** (7.17)	61.54*** (7.93)
<i>Surf</i>	-17.05*** (5.77)	-15.39** (6.27)	48.55*** (6.17)
<i>-Cost (in preference space)</i>	0.02*** (0)	0.05*** (0.19)	0.02* (0.24)
<i>N</i>	435	435	435

MNL: LogLikelihood = -1654.28, AIC/n = 1.91, McFadden's pseudo-R<sup>2</sup> = 0.13  
 MXL: LogLikelihood = -1320.01, AIC/n = 1.53, McFadden's pseudo-R<sup>2</sup> = 0.31  
 WTP in Euros with significances: \**p* < 0.1; \*\**p* < 0.05; \*\*\**p* < 0.01

**Table 11** Baseline model results including protester responses

	<b>MNL</b>	<b>MXL</b>	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
<i>Status quo</i>	86.91*** (8.81)	73.63*** (4.76)	0 (n/a)
<i>Biodiversity</i>	69.52*** (5.45)	48.84*** (3.92)	119.81*** (6.36)
<i>Beach</i>	45.84*** (4.64)	37.52*** (4.38)	86.5*** (4.34)
<i>Coast</i>	18.54*** (4.62)	32.11*** (4.41)	59.9*** (3.87)
<i>Surf</i>	-9.06* (4.67)	-9.05** (4.51)	56.43*** (4.96)
<i>-Cost (in preference space)</i>	0.01*** (0)	13.58 (0.84)	659.03*** (0.79)
<i>N</i>	918	918	918

MNL: LogLikelihood = -3433.23, AIC/n = 1.87, McFadden's pseudo-R<sup>2</sup> = 0.15  
 MXL: LogLikelihood = -2690.28, AIC/n = 1.47, McFadden's pseudo-R<sup>2</sup> = 0.33  
 WTP in Euros with significances: \**p* < 0.1; \*\**p* < 0.05; \*\*\**p* < 0.01

**Table 12** Results for model interacting with payment vehicle variable including protester responses

	MNL	MXL	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
<i>Status quo</i>	71.6*** (8.71)	55.12*** (5.87)	0 (n/a)
<i>Status quo * tax version</i>	32.26*** (5.23)	42.67*** (5)	0 (n/a)
<i>Biodiversity</i>	69.81*** (5.45)	51.91*** (4.91)	113.4*** (6.35)
<i>Beach</i>	45.95*** (4.65)	37.39*** (4.75)	86.5*** (4.28)
<i>Coast</i>	18.73*** (4.62)	33.34*** (4.79)	64.6*** (4.22)
<i>Surf</i>	-8.82* (4.66)	-8.2* (4.23)	54.84*** (4.2)
<i>-Cost (in preference space)</i>	0.01*** (0)	80.91 (1.05)	13878.98*** (0.95)
<i>N</i>	918	918	918

MNL: LogLikelihood =  
-3412.51, AIC/n = 1.86,  
McFadden's pseudo-R<sup>2</sup> = 0.15

MXL: LogLikelihood =  
-2671.51, AIC/n = 1.46,  
McFadden's pseudo-R<sup>2</sup> = 0.34

WTP in Euros with  
significances: \* $p < 0.1$   
; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

**Table 13** Final model results when controlling for PV and follow-up questions (*lack of trust in institutions, fairness concern, and disbelief in policy consequentiality*) including protester responses

	MNL	MXL	
	Coefficient (SE)	Mean (SE)	Std. Dev. (SE)
<i>Status quo</i>	55.6*** (8.92)	40.06*** (5.69)	0 (n/a)
<i>Status quo * tax version</i>	45.95*** (6.64)	50.05*** (6.26)	0 (n/a)
<i>Status quo * protesting institutions</i>	29.7*** (11.19)	19.62* (10.25)	0 (n/a)
<i>Status quo * fairness concerns</i>	19.91** (8.69)	15.78** (7.39)	0 (n/a)
<i>Status quo * disbelief in policy consequentiality</i>	40.98*** (10.24)	31.26*** (8.32)	0 (n/a)
<i>Status quo * tax version * protesting institutions</i>	-37.91** (17.06)	-12.2 (19.03)	0 (n/a)
<i>Status quo * tax version * fairness concerns</i>	-6.4 (12.1)	-5.61 (12.08)	0 (n/a)
<i>Status quo * tax version * disbelief in policy consequentiality</i>	-37.01** (14.78)	-21.56 (14.82)	0 (n/a)
<i>Biodiversity</i>	69.95*** (5.48)	46.88*** (4)	111.77*** (6.06)
<i>Beach</i>	46.29*** (4.68)	36.15*** (5.18)	81*** (4.68)
<i>Coast</i>	19.14*** (4.66)	33.11*** (3.9)	59.03*** (3.89)
<i>Surf</i>	-8.75* (4.68)	-7.92* (4.35)	58.95*** (4.25)
<i>-Cost (in preference space)</i>	0.01*** (0)	38.86 (0.92)	3829.24*** (0.84)
<i>N</i>	918	918	918

MNL: LogLikelihood = -3389.26, AIC/n = 1.85, McFadden's pseudo-R<sup>2</sup> = 0.16  
 MXL: LogLikelihood = -2667.97, AIC/n = 1.46, McFadden's pseudo-R<sup>2</sup> = 0.34  
 WTP in Euros with significances: \**p* < 0.1; \*\**p* < 0.05; \*\*\**p* < 0.01



**Fig. 3** Worldwide Governance Indicators, Portugal.  
Source: World Bank, 2024

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## Declarations

**Competing interests** The authors declare no known competing financial or personal interests that could have influenced the work reported in this paper.

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## References

- Alesina A, Stantcheva S, Teso E (2018) Intergenerational mobility and preferences for redistribution. *American Economic Review* 108(2):521–554
- Belleflamme, P., Omrani, N., & Peitz, M. (2015). The economics of crowdfunding platforms. *Information Economics and Policy*, 33, 11–28. <https://doi.org/10.1016/j.infoecopol.2015.08.003>
- Carson RT, Czajkowski M (2019) A new baseline model for estimating willingness to pay from discrete choice models. *J Environ Econ Manag* 95:57–61. <https://doi.org/10.1016/j.jeem.2019.03.003>
- Carson RT, Groves T (2007) Incentive and informational properties of preference questions. *Environ Resource Econ* 37(1):181–210
- Crowdfunding voor Natuur. (n.d.). Retrieved July 4, 2024, from <https://crowdfundingvoornatuur.nl/>
- CrowdJustice. (n.d.). It's time to take legal action against HS2. Retrieved July 4, 2024, from <https://www.crowdjustice.com/case/rethinkhs2/>
- Instituto da Conservação da Natureza e das Florestas (ICNF). (n.d.). Parque Natural do Sudoeste Alentejano e Costa Vicentina. Retrieved April 10 2024, from <https://www.icnf.pt/conservacao/rnareasprotegidas/parquesnaturais/pnsudoestealentejanocostavicentina>
- Douenne T, Fabre A (2022) Yellow vests, pessimistic beliefs, and carbon tax aversion. *Am Econ J Econ Pol* 14(1):81–110
- Dugstad A, Grimsrud KM, Kipperberg G, Lindhjem H, Navrud S (2021) Scope elasticity of willingness to pay in discrete choice experiments. *Environ Resource Econ* 80(1):2157
- Fração Santos C, Carvalho R, Andrade F (2013) Quantitative assessment of the differential coastal vulnerability associated with oil spills. *J Coast Conserv* 17(1):25–36. <https://doi.org/10.1007/s11852-012-0215-2>
- Instituto Nacional de Estatística (INE). (2024). *Web Portal*. Retrieved April 10, 2024, from [https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine\\_indicadores&indOcorrCod=0000256](https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_indicadores&indOcorrCod=0000256)
- Janeiro, J. (2018). Padrões de mesoescala regionais e a evolução da trajetória de derrames de hidrocarbonetos na costa Sul Portuguesa, Final Report, Universidade do Algarve, Portugal.
- Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A.,... & Vossler, C. A. (2017). Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists*, 4(2), 319–405.
- Kragt ME, Burton R, Zahl. Thanem, A. & Otte, P. P. (2021) Farmers' interest in crowdfunding to finance climate change mitigation practices. *J Clean Prod* 321:128967
- Louviere J (2001) Choices experiments: an overview of concept and issues. In: Blame R (ed) *The choice modelling approach to environmental valuation* (Bennet J. Cheltenham, UK, Edward Elgar Publishing Ltd, pp 13–36
- Magnussen K, Kettunen M, TEEB, N. C. (2012) Marine ecosystem services in the Barents Sea and Lofoten Islands, a scoping assessment. *Socio-economic importance of ecosystem services in the Nordic countries. Synthesis in the context of The Economics Ecosystems and Biodiversity (TEEB)*. TemaNord 559:260–265
- Mariel, P., Hoyos, D., Meyerhoff, J., Czajkowski, M., Dekker, T., Glenk, K.,... & Thiene, M. (2021). Environmental valuation with discrete choice experiments: Guidance on design, implementation and data analysis. *Springer Nature*. p. 129.
- McFadden, D. (1973). Conditional logit analysis of qualitative choice behavior. *Zarembka, P., Ed., Frontiers in Econometrics, Academic Press*, 105–142.
- McFadden D (2001) Economic choices. *American Economic Review* 91(3):351–378
- Mitchell RC, Carson RT (1989) Using surveys to value public goods. Resources for the Future, Washington, DC
- Moritz, A., & Block, J. H. (2016). Crowdfunding: A literature review and research directions. *Springer International Publishing*. pp. 25–33
- Murphy JJ, Stevens T, Weatherhead D (2005) Is cheap talk effective at eliminating hypothetical bias in a provision point mechanism? *Environ Resource Econ* 30:327–343
- Millennium Ecosystem Assessment (Program) (Ed.). (2005). *Ecosystems and human well-being: Synthesis*. Island Press.
- Revelt D, Train K (1998) Mixed logit with repeated choices: households' choices of appliance efficiency level. *Rev Econ Stat* 80(4):647–657
- Roesch-McNally GE, Rabotyagov SS (2016) Paying for forest ecosystem services: voluntary versus mandatory payments. *Environ Manage* 57(3):585–600
- Rondeau D, Schulze WD, Poe GL (1999) Voluntary revelation of the demand for public goods using a provision point mechanism. *J Public Econ* 72(3):455–470
- Rondeau D, Poe GL, Schulze WD (2005) VCM or PPM? A comparison of the performance of two voluntary public goods mechanisms. *J Public Econ* 89(8):1581–1592

- Rose SK, Clark J, Poe GL, Rondeau D, Schulze WD (2002) The private provision of public goods: tests of a provision point mechanism for funding green power programs. *Resource and Energy Economics* 24(1–2):131–155
- Sanches, E., Cancela, J. C. G., & Pereira, J. S. (2019). Instituições e qualidade da democracia: cultura política na Europa do Sul. Fundação Francisco Manuel dos Santos <https://www.ffms.pt/publicacoes/grupo-estudos/3907/instituicoes-e-qualidade-da-democracia-cultura-politica-na-europa-do-sul>
- Spencer MA, Swallow SK, Shogren JF, List JA (2009) Rebate rules in threshold public good provision. *Journal of Public Economics*, 93(5–6), 798–806.
- Stithou, M., & Scarpa, R. (2012). Collective versus voluntary payment in contingent valuation for the conservation of marine biodiversity: an exploratory study from Zakynthos, Greece. *Ocean & coastal management*, 56, 1–9.
- Stoknes PE, Soldal OB, Hansen S, Kvande I, Skjelderup SW (2021) Willingness to pay for crowdfunding local agricultural climate solutions. *Sustainability* 13(16):9227
- Swallow SK, Anderson CM, Uchida E (2018) The Bobolink project: selling public goods from ecosystem services using provision point mechanisms. *Ecol Econ* 143:236–252
- The Ocean Cleanup. (n.d.). Crowd funding campaign. Retrieved July 4, 2024, from <https://theoceancleanup.com/milestones/crowd-funding-campaign/>
- TEEB, R. O. (2010). *Mainstreaming the Economics of Nature*. TEEB Geneva, Switzerland.
- Train KE (2009) *Discrete choice methods with simulation*. Cambridge University Press
- Train, K., & Weeks, M. (2005). Discrete choice models in preference space and willingness-to-pay space. *Applications of simulation methods in environmental and resource economics*. pp. 1–16. Springer, Dordrecht.
- Veisten K, Navrud S (2006) Contingent valuation and actual payment for voluntarily provided passive-use values: Assessing the effect of an induced truth-telling mechanism and elicitation formats. *Appl Econ* 38(7):735–756
- Worldwide Governance Indicators, World Bank, 2022. <https://databank.worldbank.org/source/worldwide-governance-indicators>

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