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Analysis

Environmental attitudes and place identity as determinants of preferences for ecosystem services

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ABSTRACT

Stated preference methods are frequently employed to measure people's willingness to pay (WTP) for ecosystem services. However, these techniques are also criticized for following a simplified approach, which often ignores the role of complex psychological and sociological factors, such as general environmental attitudes and place identity beliefs. By means of a discrete choice experiment exercise, we explored the influence of general environmental attitudes and place identity perceptions on WTP, taking peatland restoration in Scotland as a case study. Our research adds to the existing literature by providing a more nuanced picture of the determinants of WTP and by exploring and mapping the distribution of the estimated welfare measures. Our results, obtained from the estimation of hybrid choice models, show that people with more positive environmental attitudes and greater attachment to peatlands and Scotland tend to display higher WTP for peatland restoration. However, differences exist across respondents, depending on their socio-demographic profile and the geographical area. A better understanding of the heterogeneity of preferences for ecosystem services is helpful to guide more efficient policy design and to inform policy-makers about the distributional impacts of planned policies for equity considerations in project appraisal.

1. Introduction

Growing awareness that nature contributes to human wellbeing by supplying ecosystem goods and services that people enjoy, has contributed, over the last decades, to increase societal demand for conservation measures to halt the unprecedented rates of environmental degradation that we are witnessing. The call for extra environmental policy efforts, though, needs to be weighted against the urgency of alternative public policy objectives (e.g. education or public health), given that public budgets are limited. In these settings, policy-makers are increasingly requested to give an economic justification for investing in conservation by providing evidence of the economic value that society places upon the environment (Martin-Ortega et al., 2015; Costanza et al., 2017). Information on such values is though often missing, since many ecosystem services are not traded in markets and surrogate markets to infer ecosystem services' values are mostly absent. Hence, to accommodate such knowledge demand, non-market valuation methods and, in particular, stated preference (SP) techniques (Hanley and Czajkowski, 2019), have been widely employed.

Despite the long tradition in the area of environmental economic valuation based on SPs, this field is sometimes criticized for being too simplistic and failing to account for the complexities that drive economic values (Costanza et al., 2017). Traditionally, it is assumed that the economic value of nature preservation – which reflects individuals' preferences and can be inferred from people's choices, subject to some constraints (e.g., income and time) – depends on the observed attributes of the environmental good of interest and the characteristics of the individual (e.g. socio-demographics, as well as past experience with the good). However, as argued by McFadden (2001), people's preferences and values are also influenced by unobservable aspects, such as

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motivations, affect, attitudes, perceptions or beliefs. Preferences can be driven by the dynamics and interactions taking place in a given social setting, as well as by the psychological processes occurring at individual level, influencing the way in which reality is perceived and valued. Accounting for these factors enriches the underlying behavioural characterisation of preferences and allows for a better understanding of the heterogeneity across individuals, hence, improving the explanatory power of valuation models (Ben-Akiva et al., 2002). Building on the above arguments, within the SP valuation literature, there has been an ongoing, but still very limited, interest in identifying and investigating the role of psychological and sociological factors as sources of preference heterogeneity, for example in relation to incidental emotions (e.g. Boyce et al., 2017), personality traits (e.g. Boyce et al., 2019), social and moral norms (e.g. Czajkowski et al., 2017a), prior knowledge (e.g. Aanesen et al., 2015), experience (e.g. Czajkowski et al., 2014), information (e.g. LaRiviere et al., 2014; Czajkowski et al., 2016b; Czajkowski et al., 2016c), and risk and uncertainty perceptions (e.g. Hunter et al., 2012; Ruokamo et al., 2016; Bartczak et al., 2017; Faccioli et al., 2019), among others. This paper contributes to this critical body of literature by focusing on the role of two aspects that have received relatively limited attention in the environmental SP literature: environmental attitudes and place identity beliefs.

The environmental psychology and sociology literatures have extensively investigated the role of environmental attitudes and identity beliefs on behaviour, finding that these are among the most important factors explaining people's support for environmental conservation (Stets and Biga, 2003; Fielding et al., 2008; Gatersleben et al., 2014). A positive environmental attitude – defined as the tendency to evaluate the environment with some degree of favour (Milfont and Duckitt, 2010) – is often found to increase the likelihood of pro-environmental behaviour in environmental psychology and sociology studies. This is because, according to the Theory of Reasoned Action (Ajzen and Fishbein, 1980), individuals are likely to behave in a way that aims to fulfil their own beliefs. Hence, if people are concerned about nature, they are likely to engage in practices that are good for the environment (e.g. recycling, choice of sustainable transport or energy savings). Given that willingness to pay (WTP) can be interpreted as a behavioural intention, expectations are therefore that stronger environmental attitudes should lead to higher WTP for environmental protection.[1] Similarly, environmental psychology studies have found that identity beliefs and, in particular, place identity[2] – perceiving oneself or a public good to be attached to, and identified with, a given context with geographical but also cultural meanings (i.e. a 'place') – correlate (sometimes positively and sometimes negatively) with people's support for environmental projects (Hernández et al., 2010; Lewicka, 2011).[3] According to identity theory (Akerlof and Kranton, 2000, 2002, 2005, 2010), individuals take decisions that are meant to fulfil and reinforce their self-perception. This is because adopting a behaviour that conforms with (versus departs from) the norms of specific social groups, which a person feels identified with, leads to a utility gain (versus loss).[4] Hence, if people feel attached to a given 'place', they are expected to be more likely to support the preservation of the local environment, if the environment is an important feature defining the identity of the 'place'. In spite of the above, the environmental SP valuation literature has paid only limited attention to environmental attitudes and place identity, with mixed evidence regarding the impact of these factors in terms of WTP and preference heterogeneity (see Section 2 for details). In addition, the existing SP literature on the topic has tended to focus either on environmental attitudes or on place identity, despite evidence from the psychology and sociology literature that the joint consideration of both aspects can enrich the understanding of people's environmental choices (Carrus and Bonaiuto, 2005; Gatersleben et al., 2014).

Using a choice experiment on preferences for peatland restoration in Scotland as a case study, this paper aims to shed light on the role of both environmental attitudes and place identity beliefs as determinants of WTP for ecosystem services. We do this by analysing the significance, magnitude and relative importance of the effect of both factors on WTP. To carry out our analysis we rely on a flexible but robust econometric approach, based on the hybrid mixed logit (HMXL) model (e.g. Hess and Beharry-Borg, 2012; Czajkowski et al., 2017b). By focusing on two relatively under-researched factors that are expected to affect the economic value of the environment, our study contributes to providing a richer understanding of the determinants of preference heterogeneity. Accounting for preference heterogeneity also provides more accurate and less biased preference and welfare measure estimates, which can guide more efficient policy design (Boxall and Adamowicz, 2002; Colombo et al., 2008; Torres et al., 2011). In addition, exploring preference heterogeneity arguably allows to better understand the distribution of the welfare impacts of planned policies across, for instance, socio-economic groups and spatial locations, which is important for equity considerations in project appraisal.

2. Environmental attitudes, place identity and SP non-market valuation

2.1. Evidence within the SP non-market valuation literature

SP valuation guidelines (see Arrow et al., 1993 and, more recently, Johnston et al., 2017) increasingly recommend the consideration of environmental attitudes in stated preferences to better characterise respondents' behaviour. Despite this, while in SP studies it is common to collect information about people's beliefs and attitudes (through 'warm up' questions or as debriefing after the valuation exercise), this information is rarely incorporated in the econometric models to explain preferences (Morey et al., 2006). In particular, information on attitudes and views towards the environment is frequently collected without relying on validated psychometric scales, such as the well-established New Ecological Paradigm (NEP) scale (Dunlap et al., 2000), which consists of 15 statements that measure general environmental attitudes (i.e. people's views about the relationships between humans and nature). To capture respondents' general environmental attitudes, SP researchers have often asked questions about membership to environmental groups or about lifestyle choices, such as recycling habits (Álvarez-Farizo and Hanley, 2002; Martín-López et al., 2007), even

[1] It is important to clarify that attitudes and preferences/WTP are not the same. The existence of an evaluative position towards something (attitude) is a necessary but not sufficient condition for preferences, in that preferences can depend upon people's attitudes towards a given situation, but additionally they also reflect information about the trade-offs that people are willing to make (Meldrum, 2015).

[2] We employ the term 'place identity' because it seems to be a well-established concept in the environmental psychology literature. However, we also acknowledge that different terms are generally used to refer to the identification with a place (e.g., 'place identity', 'place attachment', 'sense of place') and there is no agreement on whether these terms define equivalent or different constructs (Lewicka, 2011; Rollero and De Piccoli, 2010).

[3] In previous research in the field of psychology, stronger emotional bonds with a place were sometimes found to be negatively associated with people's support for environmental protection, especially in those cases where nature conservation limits local economic activities upon which the individual's livelihood depends (Vorkinn and Riese, 2001). In other circumstances, a stronger identification and attachment with a place were found to increase people's willingness to engage in activities to protect the local environment (Bonaiuto et al., 2002; Carrus and Bonaiuto, 2005).

[4] More widely, identity perceptions have also been acknowledged to drive economic behaviour and preferences in applications focusing on gender discrimination in the workplace, the economics of poverty and social exclusion, and the household division of labor. Findings, for instance, show that an employee who identifies himself as an insider in an organization and shares the company's mission, needs little monetary inducement to perform his job well.

though it is not clear whether the answers to these questions can be considered reliable indicators of environmental attitudes (Spash et al., 2009). Only a relatively small number of SP valuation studies (contingent valuation or, in fewer cases, choice experiment (CE) applications) have focused on general environmental attitudes and WTP, while relying on well-established psychometric scales (mostly the NEP or part of the scale). These are: Kotchen and Reiling (2000), Cooper et al. (2004), Milon and Scrogin (2006), Spash (2006), Meyerhoff (2006), Ojea and Loureiro (2007), Aldrich et al. (2007), Choi and Fielding (2013), Bartczak (2015), Hoyos et al. (2015), Meldrum (2015), Halkos and Matsiori (2017) and Taye et al. (2018). Results of these studies generally show that WTP tends to increase with more positive environmental attitudes. Only in some of the reviewed applications (Cooper et al., 2004; Milon and Scrogin, 2006; Halkos and Matsiori, 2017), environmental attitudes do not emerge to be strong determinants of WTP.

Regarding identity-related aspects in SP valuation, only a handful of studies are available from the literature (Hoyos et al., 2009; Andersen et al., 2012; Dallimer et al., 2013; López-Mosquera and Sánchez, 2013; Nielsen-Pincus et al., 2017). These studies have explored the link between WTP for environmental conservation and place identity (expressed as people's bonds with local culture, connection with nature, attachment to the place, etc.), finding divergent results. In Hoyos et al. (2009), Dallimer et al. (2013) and Nielsen-Pincus et al. (2017), stronger place identity and attachment were found to increase WTP, while in Andersen et al. (2012) and López-Mosquera and Sánchez (2013) cultural identity and connectedness with nature were not always found to be correlated with preferences.

2.2. Extending the evidence on the role of environmental attitudes and place identity beliefs on WTP

The existing SP evidence on the role of environmental attitudes and place identity beliefs on WTP can be improved in several ways. Firstly, studies thus far have focused either on the effect of environmental attitudes or, to a lesser extent, on the effect of place identity on preferences. No valuation study to date has simultaneously integrated both aspects in preference modelling. Given that environmental attitudes and place identity are potentially strong drivers of preferences, gathering information on the significance, magnitude and relative importance of both aspects can provide a more nuanced understanding and a better picture of the determinants of WTP. This is important because accounting for sources of explained heterogeneity of preferences provides less biased parameter estimates (Boxall and Adamowicz, 2002).[5]

More accurate preference measures can also be estimated by adopting a modelling approach that better accounts for the latent nature of attitudes and identity beliefs, such as the hybrid choice model (see Section 3). The typical modelling approach adopted by previous SP literature relies on the direct inclusion of responses to attitudinal and identity questions as explanatory variables in the model (Kotchen and Reiling, 2000; Cooper et al., 2004; Milon and Scrogin, 2006; Hoyos et al., 2009; Andersen et al., 2012; Choi and Fielding, 2013; Bartczak, 2015). Such a modelling approach is, though, subject to many limitations. Directly including attitudinal and perception information as explanatory variables in the model does not consider that the responses to attitudinal and identity questions only approximate underlying latent variables. Ignoring this aspect can lead to measurement errors, which add randomness to the model and diminish its explanatory power. Even though some of the reviewed studies (e.g., Spash, 2006; Meyerhoff, 2006; Aldrich et al., 2007) have tried to overcome this problem by identifying latent constructs,[6] typically by utilizing factor analysis, such a two-step approach is not statistically efficient. The identified factors are not necessarily the ones that provide the most explanatory power in the discrete choice component of the model (Pakalniete et al., 2017). Directly including responses to attitudinal and identity questions in the model also ignores that respondents might have different interpretations of scales and unevenly weigh the possible responses to the psychometric statements (Boyce et al., 2019). As a result, this approach can have limited explanatory usefulness, particularly if the attitudinal and identity indicators are not normalized, which can complicate the interpretation of a unit change in the arbitrary measurement scale. All the above limitations regarding the measurement and treatment of attitudinal and identity variables in previous SP studies, which can be overcome by using the hybrid choice model, can lead to inaccurate or biased results, which can be misleading in the design of efficient policies by decision-makers (Budziński and Czajkowski, 2018) and for predictive purposes.[7]

The evidence provided by the reviewed studies can also be extended by better understanding how welfare measures, environmental attitudes and place identity beliefs are distributed across individuals. Attitudes and beliefs are unlikely to be constant and, because they are linked to preferences, it is to expect that their variability leads to different welfare measures, for example, across socio-demographic groups and locations. While this information is relevant for analysts who wish to incorporate distributional effects in project appraisal, none of the studies reviewed in Section 2.1 has explored this issue so far. Environmental attitudes and, to a lesser extent, place identity beliefs are generally recognized to change depending on the socio-demographic characteristics of individuals. For example, younger people, females, individuals with higher education and higher income, living in urban areas or engaging in outdoor recreation activities, are often acknowledged to display higher environmental attitudes (Pienaar et al., 2013). Place identity perceptions tend to be higher among people with longer residence in a place, while it is less known how place identity beliefs correlate with other socio-economic factors (including age, education, having children, etc.), with erratic patterns likely to emerge (Lewicka, 2011). Only to a lesser extent, attitudes and identity beliefs are recognized to depend on geographical factors, as people with high (low) attitudes and identity beliefs are likely scattered all over the place, with no clear spatial pattern (Lewicka, 2011). This is expected to affect the spatial distribution of preferences in a way which cannot be captured through predominant theoretical frameworks explaining spatial heterogeneity of welfare estimates, such as distance effects or substitutes' availability (Bateman et al., 2005; Bakhtiari et al., 2018). Hence, exploring further sources of spatial heterogeneity may become useful for understanding spatial welfare patterns that are idiosyncratic from the perspective of economic theory (Johnston and Ramachandran, 2014; Glenk et al., 2019a).

[5] If not explicitly captured in the estimation of preferences in the model, the heterogeneity linked to place identity beliefs and environmental attitudes would be captured as unobserved heterogeneity in the distribution of random coefficients or in the model's error structure. However, as we demonstrate, it is possible to separate general environmental attitudes and place identity constructs, explicitly include them in the model, and study their correlations with preferences for choice attributes. Accounting for deviations from the assumed parametric distribution of unobserved preference heterogeneity reduces the biases resulting from misspecifications in non-linear models.

[6] Other studies (e.g. Provencher and Moore, 2006 or Morey et al., 2006) have also attempted to treat attitudinal variables (specific attitudes towards, for instance, visiting wilderness areas or fishing) as latent. However, as argued in Hess and Beharry-Borg (2012) the approach followed by these studies still relies on an inappropriate use of attitudes as explanators and their results are therefore still subject to measurement errors.

[7] An additional problem associated with directly including indicator statements in choice models is the potential endogeneity. The issue has recently received more attention and there is substantial ongoing research in this area (e.g. Rivers and Vuong, 1988; Berry et al., 1995; Train, 2009; Guevara and Ben-Akiva, 2010; Fernández-Antolín et al., 2016; Guevara and Polanco, 2016; Budziński and Czajkowski, 2018; Mariel et al., 2018).

3. Methodology

The present study aims to address the limitations of earlier research, by simultaneously exploring the role of general environmental attitudes and place identity beliefs on WTP, while relying on the hybrid choice model as an improved econometric framework. For the purposes of our research, we employ data collected through a choice experiment survey on people's stated preferences for the restoration of peatlands in Scotland (UK) and respondents' general environmental attitudes and place identity-related beliefs. With these data, we explore the significance, magnitude and relative importance of the effect of both general environmental attitudes and place identity beliefs on WTP. In addition, we also investigate the patterns of distribution of environmental attitudes, place identity beliefs and welfare measures across socio-demographic groups and geographical locations.

3.1. Case study

Peatlands cover approximately 20% of Scotland's land area (Bruneau and Johnson, 2014). As a result of past human-induced conversion to more productive land uses, such as forestry or agriculture, these ecosystems have suffered a severe process of degradation (Rotherham, 2011). Today, more than two thirds of Scottish peatlands are thought to be damaged (Bain et al., 2011) and this condition compromises the capacity of these ecosystems to deliver key services, such as water regulation, carbon sequestration and healthy habitat provision for wildlife species. In this framework, there is a growing interest among policy-makers in peatland restoration and consequently in the design of socially desirable policies, which requires gathering information on the costs-benefits and public acceptability of restoration efforts (Scottish Natural Heritage, 2015).

The study of preferences for peatland restoration in Scotland offers a particularly interesting setting to analyse the role of environmental attitudes and place identity. First, available evidence collected in the 2008 survey on Scottish people's environmental attitudes and behaviour (Scottish Government, 2009) shows that attitudes towards the environment are generally high in Scotland and they are linked with pro-environmental behaviours, with the most environmental conscious respondents tending to be more engaged in 'green' lifestyle choices. Second, the Scottish population generally displays a heightened degree of place identity and, in particular, national identity (Simpson and Smith, 2014), which, in the context of our study, is defined as the sense of attachment to Scotland, its traditions, land and people.[8] As part of this strong sense of identification with Scotland and its landscape, Scottish residents tend to identify peatlands as iconic ecosystems in Scotland (Byg et al., 2015). Peatlands provide many people with a 'sense of place'. Characteristic peatland landscapes have been shown to provide local communities with a sense of inspiration and connectedness with their natural environment and with the culture and traditions of the place (Bain et al., 2011; Byg et al., 2017). Because of this, attachment and sense of place are often argued to be explicit benefits of peatlands in Scotland (Scottish Natural Heritage, 2015).

[8] A strong sense of national identity in Scotland finds its roots in the Middle Age, when Scotland and England were divided but constantly in conflict due to England's ambition to rule over an independent Scotland. These tensions have contributed to strengthen Scotland's sense of belonging and strive for autonomy. Based on the 2011 Census data, 62.43% of all residents in Scotland today declare to have only a Scottish identity, with this figure constantly raising over the past two decades at the expenses of British, English or any other UK identities. A manifestation of this sense of 'Scottishness' was the 2014 referendum, where Scotland voted to ask for more independence from the rest of the UK. More recently, arguments in favour of an independent Scotland have become even stronger, following the 2016 Brexit vote.

3.2. Choice experiment design

The data utilised for this paper come from a CE survey, described in more detail in Glenk and Martin-Ortega (2018). In the CE, a sample of Scottish residents was asked to repeatedly choose their most preferred environmental policy alternative, among a number of options, each described by a different combination of attributes. In particular, our CE focused on (hypothetical) peatland restoration options by 2030. Each respondent was presented with eight choice sets, showing three alternatives each. Two alternatives, changing between choice situations, described the outcomes of hypothetical restoration programmes to bring Scottish peatlands' ecological condition to good status. The third alternative, constant across the choice situations, represented a business as usual (BAU) scenario and showed what would occur by 2030, if no additional action was taken.

Each peatland restoration programme was described by five attributes, summarized in Table 1. Two attributes described percentage shifts in the ecological condition relative to the share of peatlands in each condition in a BAU scenario. We considered three ecological conditions: bad, intermediate and good. Given the lack of observed data on peatland extent and condition, we carried out a focus group with Scottish peatland experts. Based on their assessment, 30% of peatlands were currently estimated to be in bad ecological condition (40% in the BAU case by 2030); 40% in intermediate condition (40% in the BAU case by 2030) and 30% in good ecological condition (20% in the BAU case by 2030). Attribute levels were defined based on experts' informed predictions about the share of peatlands in intermediate and bad condition that could be shifted to good ecological condition through restoration by 2030. Improvements in peatland condition are associated with an increase in the provision of ecosystem services, such as climate change mitigation (carbon storage), water quality improvement and greater biodiversity. Respondents were confronted with a detailed explanation of how changes in peatlands' ecological condition are related to variations in the ecosystem services provided by these habitats.

Two additional attributes considered in the CE were spatial criteria that indicate where the hypothetical restoration programmes would take place in Scotland. The criteria emerged to be relevant in preparatory focus groups with the public (see Byg et al., 2017 and Martin-Ortega et al., 2017 for further details). The first criterion describes the degree of peatland concentration in a given area and was described in terms of whether restoration would take place in locations where peatlands cover more than or less than 30% of the land surface (high or low peat concentration). The second spatial criterion was related to the degree of remoteness or accessibility of a peatland and it was operationalized in terms of whether restoration would take place in remote and inaccessible sites (wild land areas) or in relatively accessible locations. In the survey, maps were created to illustrate to respondents the location of the remote and accessible sites, as well as the areas with high or low peat concentration.

The fifth attribute considered in the study was a cost attribute. This was framed as an annual tax towards a hypothetical Peatland Trust that all residents in Scotland would pay to contribute to the funding of the peatland restoration programmes.

The CE alternatives were created by combining different attribute levels by means of a D-efficient Bayesian experimental design optimised for a multinomial logit model using prior parameter estimates based on a pilot study (N = 100). An example of a choice card is presented in Fig. 1. The CE was the result of an intensive preparatory work involving several rounds of focus groups and pre-testing with the public, in addition to consultations with peatland specialists (Martin-Ortega et al., 2017).

3.3. Environmental attitudes and place identity

In the survey, general environmental attitudes – reflecting people's beliefs about the environment and the role of humans on nature – were

Table 1
Description of the choice experiment attributes and their levels.

Attributes' description	Levels
Improvement in the share of peatlands from bad to good ecological condition (relative to the business as usual)[a]	0%, 10%, 20%, 30%
Improvement in the share of peatlands from intermediate to good ecological condition (relative to the business as usual)[a]	0%, 10%, 20%, 30%
Peatland restoration in wild land areas	Yes, No
Peatland restoration in areas with high or low 'concentration' of peatlands	High, Low
Annual cost per household (£)[b]	T1: 10, 15, 30, 45, 90, 150 T2: 10, 25, 50, 75, 150, 250 T3: 10, 40, 80, 120, 240, 400

[a] The changes listed in the table refer to the increase in the *absolute* share of peatlands in good condition, resulting from the restoration of peatlands in bad or intermediate ecological condition. Changes are relative to the business as usual scenario, which is defined as having 40% of peatlands in bad, 40% in intermediate and 20% in good condition. For modelling purposes, the variations in the share of peatlands were coded as the *relative* percentage changes in the *absolute* share of peatlands in bad or intermediate condition that would be shifted from the business as usual level to good condition, as a result of restoration. As explained in more detail in Glenk and Martin-Ortega (2018), the possible levels of relative change in the absolute share of peatlands that would be shifted from bad or intermediate to good condition are 0%, 25%, 50% and 75%. Estimated marginal utility therefore refers to a 1% shift from bad or intermediate to good condition, relative to the business as usual scenario. In the choice cards, respondents were shown the absolute shares of peatlands' conditions resulting from the proposed restoration. Given the above, respondents could see shares in good condition ranging between 20% and 80% (starting from 20%, the business as usual level, plus a maximum of a 2 × 30% improvement in the share of peatlands in good condition that would result from the restoration of all feasible sites in bad and intermediate condition).

[b] In the survey, three cost vector treatments (T1, T2, T3) were considered and respondents were randomly assigned to one of them. Investigating differences between these treatment groups of almost equal size is not the focus of this study and is reported elsewhere (Glenk et al., 2019b), so this study uses the pooled data i.e. includes all three treatments. Scale differences can be possible across different cost vector treatments, as treatments with low costs can be more or less deterministic than those with high costs. In our model, however, we don't explicitly control for potential scale differences and this is a limitation of our study.

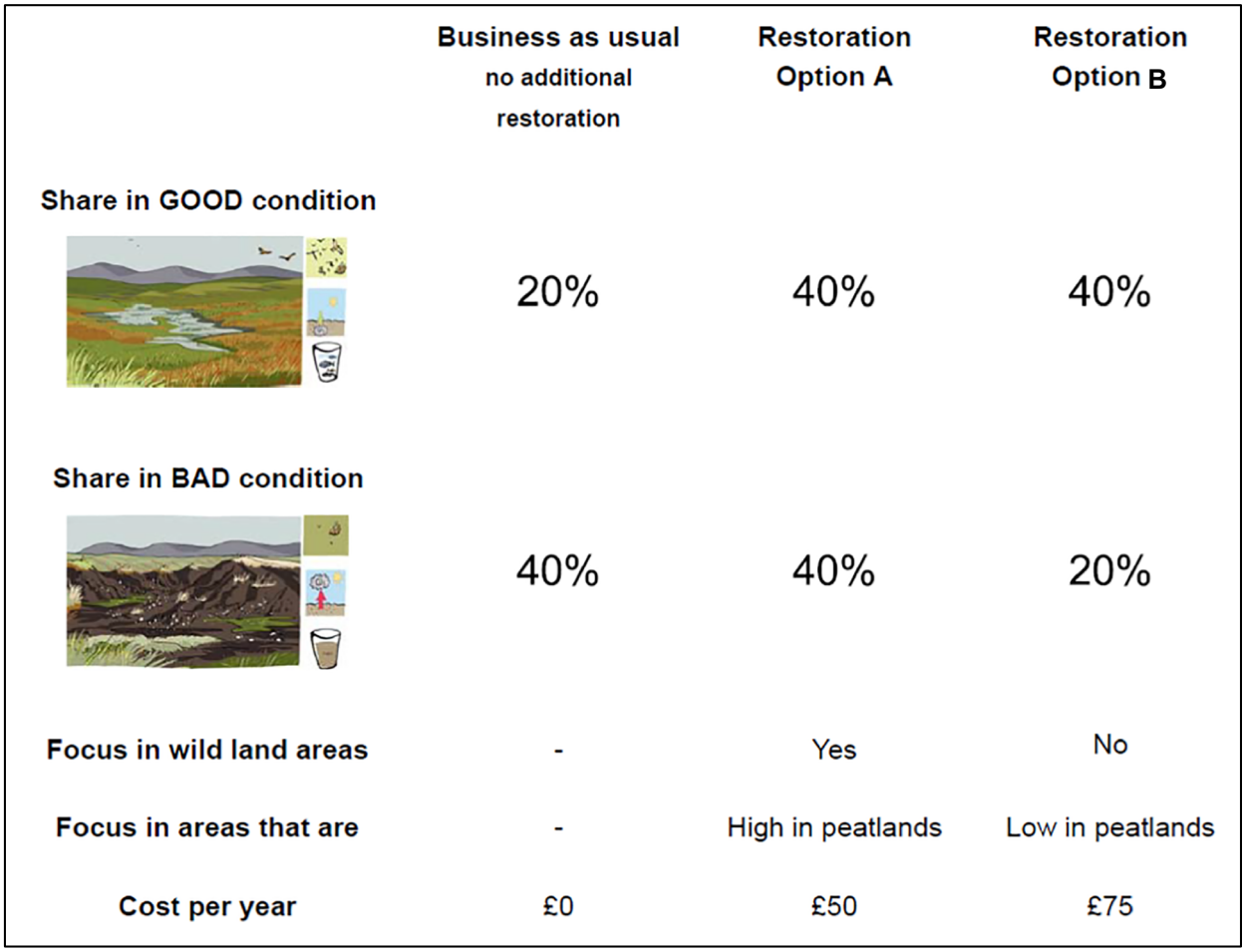

Fig. 1. An example of a choice card.

measured by collecting respondents' views about each of the 15 statements constituting the revised NEP scale (Dunlap et al., 2000), reported in Appendix 1. Information was also collected on respondents' place identity beliefs and, in particular, on national identity perceptions, referring to the bonds with and attachment to Scotland. While different scales are available from the literature to measure place identity constructs, no single scale is overwhelmingly more reliable or superior than others (Lewicka, 2011). An alternative approach, and the one used here, is to develop ad hoc statements. Four different questions (reported in Appendix 1) were therefore specifically designed to understand the

degree to which individuals perceive peatlands as part of Scotland's identity and landscape and the extent to which people feel identified with and attached to Scotland. To develop these statements we considered, as a starting point, the discussions held during preparatory focus groups (Byg et al., 2015; Byg et al., 2017) and the available literature (Stets and Biga, 2003; Scottish Natural Heritage, 2015; Joint Nature Conservation Committee, 2011; Waylen et al., 2016). Respondents were asked to indicate their degree of agreement or disagreement with each of the general environmental attitude and place identity statements, based on a 4-points Likert scale (1 = completely disagree, 2 = somewhat disagree, 3 = somewhat agree and 4 = completely agree).

3.4. The sample

The survey was administered online via a professional market research company during February/March 2016 to a sample of 1795 Scottish residents selected from an online panel, using a quota-based approach, with age and gender as 'hard' quotas and a 'soft' quota for social grade. The sample was representative of the population of Scotland in terms of gender, age, and the rural/urban split (with 65% of the respondents living in the main cities, located close to small pockets of peat but far away from wild peatlands and areas with lots of peat). Respondents with higher educational attainment levels and higher employment-based social grade are slightly over-sampled. Socio-demographic characteristics of the sample, collected through specific questions included in the survey, are reported in Appendix 2, together with information about the socio-demographic profile of the overall Scottish population.

3.5. Econometric approach

Our econometric approach relies on the use of hybrid choice models (Ben-Akiva et al., 2002). This modelling approach has thus far largely been applied in the transportation literature (e.g. Morikawa et al., 2002; Hess et al., 2012; Daziano and Bolduc, 2013; Motoaki and Daziano, 2015) with an increasing number of applications in the environmental economics' literature (e.g. Dekker et al., 2012; Hess and Beharry-Borg, 2012; Adamowicz et al., 2014; Hoyos et al., 2015; Mariel et al., 2015; Mariel and Meyerhoff, 2016; Czajkowski et al., 2017a; Czajkowski et al., 2017b; Pakalniete et al., 2017; Taye et al., 2018; Boyce et al., 2019; Zawojska et al., 2019).

The hybrid choice model is a structural model that combines choice and non-choice components. It allows to incorporate perceptions and cognitive processes into a Random Utility Model (RUM) framework, thus providing a link between behavioural sciences (e.g. psychology)

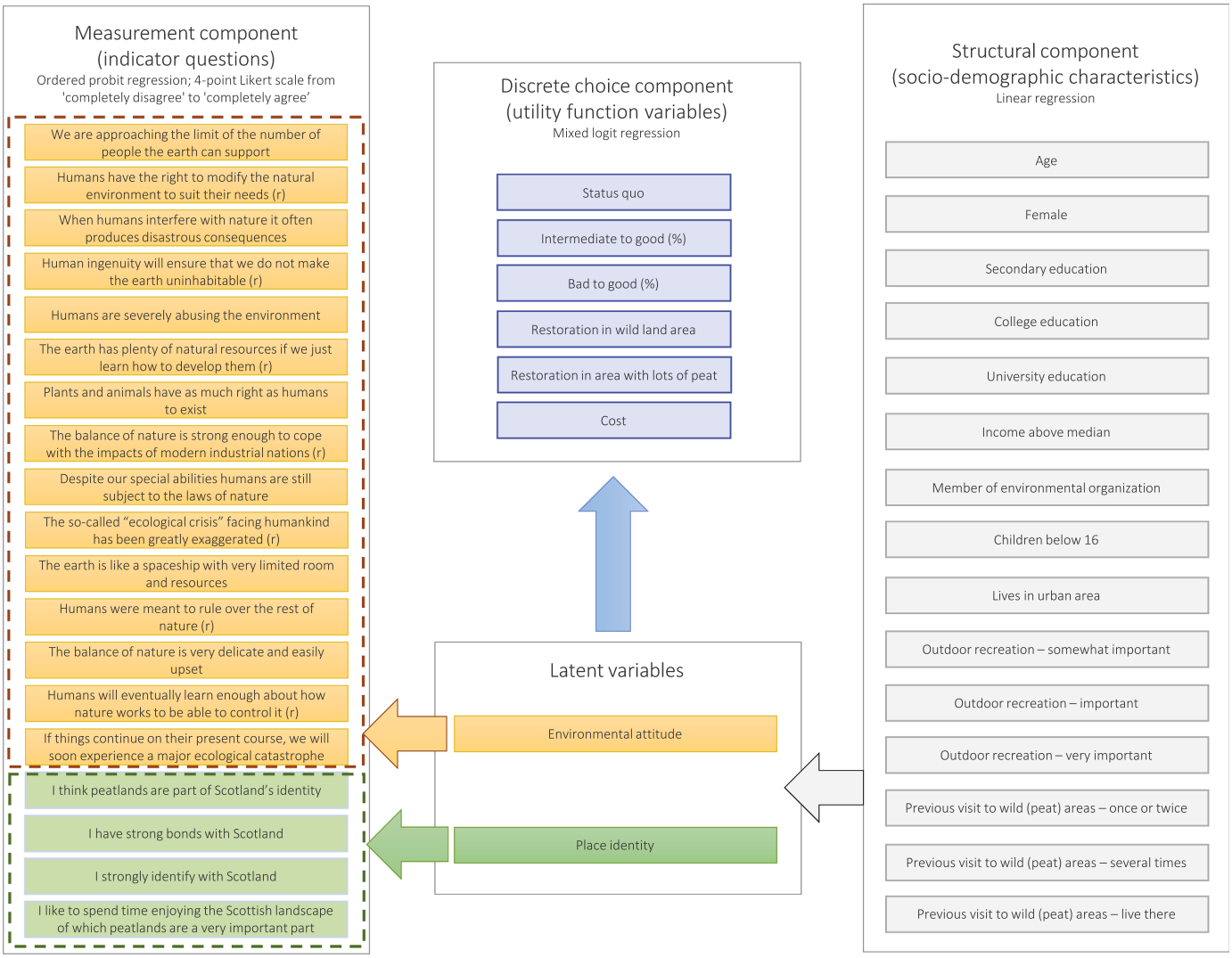

Fig. 2. The structure of our hybrid choice model.

and disciplines oriented towards the study of people's choices (e.g. economics). The main advantage of the hybrid choice model framework is the possibility of including latent constructs that may not be directly observable and instead are measured using a set of indicator variables. Therefore, hybrid choice models are particularly suitable to isolate the effect of psychological constructs on preferences and willingness to pay.

The estimation of hybrid choice models is computationally intensive and complex and there is an open debate regarding whether their use is justified (Mariel and Meyerhoff, 2016). Vij and Walker (2016) note that hybrid choice models can sometimes be reduced to a choice model without latent variables, which would fit the choice data at least as well. However, Vij and Walker (2016) list several reasons why the use of hybrid choice models may be worthwhile: (1) these models may lead to an improvement in the analyst's ability to predict choices, (2) they allow for the identification of structural relationships between observable and latent variables, (3) they can correct for biases arising from omitted variables and measurement error, (4) they are likely to lead to lower variance of parameter estimates and (5) they may abet practice and policy in ways that would not be possible using the reduced form choice model. In our case, an alternative to a hybrid choice model would be a choice model which directly interacts preference parameters with some indicator variables (or their composite indexes). This represents a frequently used approach in previous SP studies dealing with attitudes and beliefs. However, as the indicator variables are just functions of attitudes or perceptions, rather than their direct measure (Chorus and Kroesen, 2014), using such indexes directly in the choice model would incorporate a measurement bias (Budziński and Czajkowski, 2018).

The three sub-sections that follow formally describe the different components of the hybrid choice model used in this study, namely the discrete choice component, measurement equations and the structural component. The structure of our hybrid choice model is summarized in Fig. 2.

3.5.1. A discrete choice component

Responses to the discrete choice experiment are modelled based on the random utility maximization framework (McFadden, 1974), according to which individuals choose the alternative that maximizes their level of utility. Formally, the utility that individual i derives from choosing variant j in choice task t can be expressed by:

$$U_{ijt} = \alpha_i(\mathbf{X}_{ijt}\boldsymbol{\beta}_i - c_{ijt}) + \varepsilon_{ijt} \quad (1)$$

Individual's utility is defined by deterministic and non-deterministic components. The deterministic components are related to the observed characteristics of the project and the non-deterministic ones are linked to unobserved idiosyncrasies. In particular, $\mathbf{X}$ represents the levels of the non-monetary attributes associated with a project of peatland restoration; c_{ijt} denotes the level of the monetary attribute; the stochastic element ε captures factors unobserved by the econometrician that influence the individual's utility (choices) and this error term is assumed to follow a Gumbel, type I extreme value distribution. $\boldsymbol{\beta}_i$ and α_i are individual-specific parameters to be estimated and they express the individual's preferences towards the project's characteristics: β_i is a vector of preference parameters for the non-monetary attributes, while α_i is the parameter associated with the monetary attribute. Note that the multiplication of all attributes by the parameter of the monetary attribute (α_i) allows to directly interpret the vector of preference parameters β_i as a vector of implicit prices (marginal WTPs) for the non-monetary attributes X. In addition to facilitating the interpretation of the results, another advantage of this formulation is the possibility of specifying a particular distribution of WTP in the population (rather than specifying the distribution of the underlying utility parameters), thus avoiding implausible WTP values. Following common practice, we assume that the parameters of the non-monetary attributes are normally distributed and the parameter of the monetary attribute is log-normally distributed. Our model allows for full correlation structure of the random parameters $\boldsymbol{\beta}_i$ and α_i by estimating all elements of the Cholesky decomposition of the variance-covariance matrix. Thus, our estimated model corresponds to a hybrid mixed logit (HMXL) model with correlation.

In particular, one aspect of the utility specification in (1) needs some emphasis. Following the approach proposed by Bahamonde-Birke et al. (2017), the parameters $(\alpha, \boldsymbol{\beta})$ are assumed to depend on the unobservable latent variables. We denote a vector of individual-specific latent variables by $\mathbf{LV}_i$ (in our case, this vector consists of two elements: general environmental attitudes and place identity perceptions).[9] Then, the relationship between the non-monetary preference parameters and the latent variables can be illustrated by:

$$\boldsymbol{\beta}_i = \boldsymbol{\Lambda}'\mathbf{LV}_i + \boldsymbol{\beta}_i^* \quad (2)$$

where $\boldsymbol{\Lambda}$ is a matrix of coefficients to be estimated and $\boldsymbol{\beta}_i^*$ has a multivariate normal distribution with a vector of means and a covariance matrix to be estimated. Similarly, the relationship between the parameter of the monetary attribute and the latent variables is the following:

$$\alpha_i = \exp(\boldsymbol{\tau}'\mathbf{LV}_i + \alpha_i^*) \quad (3)$$

where $\boldsymbol{\tau}$ is a vector of coefficients to be estimated and α_i^* is log-normally distributed, with the parameters describing its mean and its standard deviation to be estimated. Note that we allow the latent variables to independently enter each of the parameters linked to the non-monetary and monetary attributes. As a result, and given that we estimate the model in WTP-space, the variation in a LV can be associated with changes in both the numerator and the denominator of the ratio reflecting the WTP for an attribute change, and we are therefore able to observe the net effect.

3.5.2. Measurement equations

We define separate latent variables to capture respondents' general environmental attitudes, as well as place identity perceptions. These attitudes and beliefs are unobservable factors, which may be related to respondents' preferences, but cannot be measured in a direct and objective way, as we would do with age or income. To assess general environmental attitudes our survey included 15 indicator questions (as part of the NEP scale), while to measure place identity beliefs we relied on 4 indicator questions. Responses to the indicator questions are expected to be determined by the person's true environmental attitudes and place identity beliefs, which are latent variables. Measurement equations therefore model the self-reported measures of the beliefs and attitudes, as a function of the latent variables. Formally, this relationship can be expressed as:

$$\mathbf{I}_i = \mathbf{LV}_i\boldsymbol{\Gamma} + \boldsymbol{\eta}_i \quad (4)$$

[9] In some psychology studies, identity beliefs are sometimes modelled as factors mediating the effect of attitudes on pro-environmental behaviour. This is particularly the case when identity represents a sub-dimension of attitudes. For instance, van der Werff et al. (2013) find that people with biospheric values (who believe in the need to protect the environment) are also likely to see themselves as environmental-friendly individuals (they tend to have an environmental self-identity) and to behave pro-environmentally. Based on this, van der Werff et al. (2013) modelled identity as a mediating factor between attitudes and behaviour. In our case, though, place identity beliefs and general environmental attitudes are different constructs and there is no reason why, as also found in Carrus and Bonaiuto (2005), people with a greater sense of national pride should have more positive general environmental attitudes and, hence, why identity should be a mediating factor. This is why we consider general environmental attitudes and place identity beliefs as separate factors and we simultaneously study their individual effect.

where $\mathbf{I}_i$ are indicator variables (each of the self-reported responses to the statements summarized in Appendix 1) which are linked through Eq. (4) to the corresponding LV that they contribute to measure; $\mathbf{\Gamma}$ is a matrix of coefficients; and $\boldsymbol{\eta}_i$ is a vector of error terms assumed to follow a multivariate normal distribution with zero means and an identity covariance matrix.

The econometric framework that we use has several advantages. First of all, the responses to the attitudinal questions were collected using 4-point Likert scales (see Appendix 1). It is common in the psychometric literature to impose an absolute interpretation on these Likert-scale responses. Instead, in the measurement component of our model, we use an ordered probit for the indicator variables to capture the ordinal nature of the response scale, without imposing any restrictions. This approach also allows to assign (potentially) different weights to each of the possible response options to the indicator statements. This way, we do not mis-interpret the responses and avoid potential biases that would result from using, for example, linear regressions (Greene, 2017).[10] Secondly, each of the latent variables was measured using several attitudinal and belief questions. In earlier studies, the responses to each of the questions related to the latent variable of interest are often simply added up, following possible reverse coding, as necessary (e.g. Gosling et al., 2003). Our framework, however, accounts for the possibility that some of the questions are more efficient than others in measuring a particular latent variable. This way, each latent variable enters the measurement equations of each associated indicator question with a separate coefficient, hence allowing for an independent relationship. Finally, all components of our model are estimated jointly – the model is estimated using a full information log-likelihood function (see Section 3.5.4). Other studies have employed a two-step approach in which, for example, individual factor scores are derived first and, in a second step, they are interacted with utility function parameters (e.g. Nunes and Schokkaert, 2003; Milon and Scrogin, 2006). By estimating both steps simultaneously, our model is statistically more efficient.

3.5.3. Structural component

Latent variables can also directly depend on exogenous factors, such as socio-demographic variables, which are included in the vector $\mathbf{X}_i^{str}$. This relationship is described by the following structural equations:

$$\mathbf{LV}_i = \mathbf{X}_i^{str}\mathbf{\Psi} + \boldsymbol{\xi}_i \tag{5}$$

where $\mathbf{\Psi}$ is a matrix of coefficients and $\boldsymbol{\xi}_i$ are error terms which are assumed to come from a multivariate normal distribution. Generally, linking socio-demographic variables with latent variables through structural equations is not compulsory. However, the great benefit when adding them is that we learn what drives variations in the latent variables, rather that assuming (in the absence of structural equations) that latent variables depend on some random components.

The identification of the model is ensured through the normalization of the scale of every latent variable (Hess et al., 2012). We do this by normalizing the variance of the error terms in the structural equations (Raveau et al., 2012), which ensures that the variance of every latent variable in $\mathbf{LV}_i$ is equal to one. Although such an approach introduces additional non-linearities in the model, it is very useful. By following such a procedure, it is possible to make sure that all latent variables have the same scale (even with socio-demographic variables in the structural equations) and therefore that the relative importance of the latent variables (e.g. in measurement equations) can be easily assessed.[11]

3.5.4. Estimation

The full-information likelihood function is presented in Eq. (6):

$$L_i = \int P(\mathbf{y}_i \mid \mathbf{X}_i, \mathbf{X}_i^{str}, \boldsymbol{\beta}_i^*, \alpha_i^*, \boldsymbol{\xi}_i^*, \mathbf{\Lambda}, \mathbf{\Gamma}, \mathbf{\Psi}) P(\mathbf{I}_i \mid \mathbf{X}_i^{str}, \boldsymbol{\xi}_i^*, \mathbf{\Lambda}, \mathbf{\Gamma}, \mathbf{\Psi}) f(\alpha_i^*, \boldsymbol{\beta}_i^*, \boldsymbol{\xi}_i^*) d(\alpha_i^*, \boldsymbol{\beta}_i^*, \boldsymbol{\xi}_i^*) \tag{6}$$

where $\mathbf{y}_i$ represent respondent i's choices.

Given that the random disturbances of $\boldsymbol{\beta}_i^*$ and the (non-normalized) error terms in the structural equations $\boldsymbol{\xi}_i^*$ are not directly observed, they must be integrated out of the conditional likelihood. This multi-dimensional integral can be approximated using a simulated maximum likelihood approach. To simulate the log-likelihood function, we used 10,000 Sobol draws with a random linear scramble (Czajkowski and Budziński, 2019).

4. Results

4.1. Environmental attitudes and place identity perceptions

Generally, respondents tend to agree with most of the NEP statements presented (as reported in Appendix 1). This suggests that, overall, participants show positive attitudes towards the environment, which indicates a pro-environmental worldview, consistently with the results of previous surveys to the Scottish population (Scottish Government, 2009). Regarding place identity perceptions, answers to the indicator variables (summarized in Appendix 1) show, in line with expectations, that most of respondents feel a relatively high degree of attachment to Scotland and a strong sense that peatlands are an integral part of the Scottish identity and landscape.

4.2. Choice experiment results

Model results, obtained after removing protest bidders and missing values in the variables of interest,[12] are shown in Table 2.

To interpret the results, we start by focusing on the measurement equation part of the model displayed in Table 2. This allows to understand the link between: i) the unobserved true (latent) individuals' general environmental attitudes, as well as place identity perceptions, and ii) the responses to the statements presented in Appendix 1. We explained each NEP statement as a function of one latent variable

[10] Many studies assume linear relationships between responses (i.e. equal distances between response scales). For example, they interpret 'I disagree strongly' as 1, 'I disagree moderately' as 2 and so on. This is a very strong assumption to impose, since the differences between response categories are much subtler. While there could be very little difference between 'I disagree strongly' and 'I disagree moderately', there could be more differences between 'Neither agree nor disagree' and 'agree a little'. Using the ordered probit model does not impose such restrictions – it uses an ordinal scale to interpret the scores provided by people and flexibly sets the thresholds between neighboring responses.

[11] The models presented in this paper were estimated using a DCE package developed in Matlab and available from http://github.com/czaj/DCE. The code and data for estimating the specific models presented in this study, as well as supplementary results, are available following this link: http://czaj.org/research/supplementary-materials.

[12] From the initial dataset including N = 1795 respondents, we excluded N = 58 individuals who always chose the status quo option and motivated their choices due to protest reasons. This reflects common practice in SP studies. However, we acknowledge that there are different positions in the literature regarding the treatment of protest responses (Glenk et al., 2012; Ardeshiri et al., 2019). From the initial dataset, we also excluded N = 11 cases where missing data were detected in the choice experiment part of the survey and N = 306 cases of missing information in the relevant attitudinal, identity or socio-demographic variables. In addition, we also filtered out N = 51 individuals who reported the same level of agreement or disagreement with all NEP statements. This is because such behaviour does not provide consistent information on respondents' environmental attitudes, but rather suggests some randomness in responses, given that positive environmental attitudes imply agreement with half of the NEP statements and disagreement with the other half. Overall, we detected some degree of overlap between the different categories of excluded individuals.

Table 2
Results of the HMXL model focusing on general environmental attitudes and place identity.

The discrete choice component (WTP-space, in GBP)				
	Means	Standard deviations	Interaction with LV_1 (positive general env. attitudes)	Interaction with LV_2 (strong place identity)
Status quo	−137.88***	85.02***	−17.32***	−5.67**
	(5.18)	(4.50)	(2.46)	(2.89)
Bad to good (1% shift)	0.94***	1.54***	0.37***	0.18***
	(0.05)	(0.05)	(0.04)	(0.06)
Intermediate to good (1% shift)	0.66***	0.98***	0.25***	0.12***
	(0.03)	(0.04)	(0.03)	(0.04)
Restoration in wild land area	30.92***	42.58***	11.68***	5.44***
	(2.10)	(1.84)	(1.40)	(1.61)
Restoration in area with lots of peat	14.39***	42.48***	1.98	2.59
	(2.00)	(2.16)	(1.31)	(1.61)
-Cost/100	1.27***	1.22***	−0.08*	−0.02
	(0.05)	(0.08)	(0.05)	(0.05)
The measurement component[a]				
			LV_1 (positive general env. attitudes)	LV_2 (strong place identity)
We are approaching the limit of the number of people the earth can support			0.6134***	
			(0.0397)	
Humans have the right to modify the natural environment to suit their needs (r)			0.5503***	
			(0.0374)	
When humans interfere with nature it often produces disastrous consequences			0.7115***	
			(0.0445)	
Human ingenuity will ensure that we do not make the earth uninhabitable (r)			0.4857***	
			(0.0362)	
Humans are severely abusing the environment			1.0376***	
			(0.0580)	
The earth has plenty of natural resources if we just learn how to develop them (r)			0.1287***	
			(0.0320)	
Plants and animals have as much right as humans to exist			0.7302***	
			(0.0478)	
The balance of nature is strong enough to cope with the impacts of modern industrial nations (r)			0.8951***	
			(0.0489)	
Despite our special abilities humans are still subject to the laws of nature			0.5074***	
			(0.0404)	
The so-called “ecological crisis” facing humankind has been greatly exaggerated (r)			0.9602***	
			(0.0507)	
The earth is like a spaceship with very limited room and resources			0.6768***	
			(0.0413)	
Humans were meant to rule over the rest of nature (r)			0.7311***	
			(0.0429)	
The balance of nature is very delicate and easily upset			0.9363***	
			(0.0530)	
Humans will eventually learn enough about how nature works to be able to control it (r)			0.4002***	
			(0.0346)	
If things continue on their present course, we will soon experience a major ecological catastrophe			1.1547***	
			(0.0608)	
I think peatlands are part of Scotland's identity				0.7115***
				(0.0452)
I have strong bonds with Scotland				6.5568***
				(1.9501)
I strongly identify with Scotland				3.5706***
				(0.3054)
I like to spend time enjoying the Scottish landscape of which peatlands are a very important part				0.7207***
				(0.0447)

Notes: ***, ** and * respectively indicate 1%, 5% and 10% significance levels and refer to the results of a two-sided test. All utility function parameters are modelled as random, correlated and normally distributed (except for the cost parameter, which is assumed to follow a log-normal distribution; the estimates of the underlying normal distribution are reported in Table 2; in the model, we use the negative of the *Cost* attribute expressed in 100 GBP). Correlation parameters are reported in the supplementary materials available online (Appendix 4). (r) indicates that the statement was reverse-coded.

[a] The estimated ordered logit threshold parameters are not reported here for brevity. We include full results in the supplementary materials available online (Appendix 4).

(LV1), which therefore reflects respondents' general environmental attitudes. Similarly, we modelled each identity-related statement, capturing respondents' identification with Scotland and perception of the role of peatlands in Scotland's identity and landscape, as a function of a separate latent variable (LV2), which we denominate 'place identity' perception. Results of the measurement equations indicate that individuals' responses to each NEP statement are significantly and positively related to the first latent variable (LV1) and, hence, that LV1 reflects positive general environmental attitudes. Respondents' answers to the identity-related statements indicate a significant and positive relationship with the second latent variable (LV2). LV2, thus, reflects a high attachment to Scotland and a positive perception that peatlands are an important part of Scottish identity and landscape.

The discrete choice component of the model, displayed in the upper part of Table 2, reports respondents' WTP (mean and standard deviation) for peatland restoration attributes, along with the interactions between WTP and each of the identified LVs.[13] This part of the model shows whether and how preferences differ across individuals depending on the latent traits displayed. Based on our results, on average, respondents have significant preferences for moving away from the BAU scenario and for the implementation of peatland restoration projects in Scotland. Our surveyed individuals display a positive WTP for an improvement in peatlands' condition, with the WTP for a 1% shift in peatlands' condition from bad to good being higher than the WTP for a 1% shift from intermediate to good condition, indicating sensitivity to scope. Additionally, individuals display positive WTP for the restoration of peatlands in wild and relatively inaccessible areas and in areas with a relatively high share of peatlands in the land cover. We note the existence of considerable preference heterogeneity, as indicated by relatively large estimates of the standard deviations of WTP distributions.

Of specific interest for the purpose of this study, are the interactions between preferences and LV1, as well as LV2. Model results indicate that WTP is significantly correlated with environmental attitudes and respondents' place identity perceptions. The interaction between LV1 and the choice part of the model is significant and positive, suggesting that individuals displaying positive environmental attitudes, experience: i) higher disutility resulting from the BAU situation and ii) higher WTP for all peatland restoration attributes (except for the attribute indicating restoration in areas with high concentration of peat). Similar conclusions can be drawn also regarding the effect of place identity perceptions, captured by LV2. Respondents having high attachment and bonds with Scotland and those who think that peatlands are an important part of Scotland's identity and landscape are found to display significantly higher WTP for peatland restoration.

The magnitude of the interaction coefficients can be directly compared to draw conclusions about the relative effect of environmental attitudes and place identity on WTP. This is possible due to the normalization of each latent variable for zero mean and unit standard deviation. The interaction coefficients indicate the difference in WTP, relative to the sample average, for those respondents whose environmental attitude or place identity perceptions are one standard deviation above the sample mean (i.e. positive coefficients indicate higher WTP, while negative coefficients indicate lower WTP). For instance, based on our results in Table 2, the WTP for the BAU situation, which is −137.88 GBP on average for the sample, would be 17.32 GBP lower for those respondents whose general environmental attitudes are one standard deviation above the sample's mean. In turn, the WTP for the BAU situation would be 5.67 GBP lower for those respondents having a unit standard deviation stronger place identity. Based on our results (as reported in Table 2), similar conclusions can be drawn also when considering the WTP for other attributes. Overall, while we find that both LV1 and LV2 exert a non-negligible and statistically significant effect on WTP, general environmental attitudes play a bigger role than place identity perceptions.

Given the considerable variability in preferences, as signalled by the large coefficients of standard deviation estimated in Table 2, it is worth exploring how preferences differ across individuals. Table 3 presents the structural component of the model displayed in Table 2. This part of the model allows to better understand the socio-demographic profile of those respondents who are more (or less) likely to display the identified latent traits and who are, accordingly, more (or less) likely to have higher (or lower) welfare measures associated with peatland restoration policies. Where possible, we focused on those variables that the psychology and sociology literatures have previously considered when studying the socio-demographic determinants of general environmental attitudes and place identity beliefs (see Section 2.2). Table 3 only reports those variables that, based on our results, significantly explain the latent variables of interest.[14] Results confirm that indeed some socio-demographic groups are more likely than others to display the latent traits associated with LV1 and LV2. Women and those respondents who rate outdoor recreation activities as important are more likely to display both higher environmental attitudes and place identity perceptions. Similarly, members of environmental organizations are also more likely to display higher environmental attitudes. Hence, based on the above, women, people actively engaged in outdoor recreation and members of environmental groups tend to benefit more from policies of peatland restoration, compared to their counterparts. Unlike these, people with a higher income (above the median for the sample) are less likely to display stronger environmental attitudes and therefore they tend to display lower welfare gains from peat restoration. It is less clear whether to expect respondents to benefit more or less from peatland restoration depending on their age and whether the person has children or grandchildren below age 16. In fact, based on our findings, elderly respondents tend to display higher degrees of place attachment, which contribute to increased perceived benefits from peatland restoration, but they display also less positive environmental attitudes, which are associated with lower perceived benefits from peatland restoration. Similar conclusions can be drawn also for those respondent having young children or grandchildren.[15]

We also explore the distribution of preferences across locations, by mapping the estimated individual-specific WTP scores by postcode area (based on respondents' place of residence). We employed the Bayes formula (Revelt and Train, 2000; Campbell et al., 2008; Train, 2009) to calculate the expected WTP for each respondent, conditional on individual choices, starting from the use of priors drawn from the population-level distributions (mean and standard deviation estimated in the model in Table 2). Fig. 3 reports the maps, obtained with QGIS 2.18, which illustrate the mean of individual-specific WTP scores by postcode area, for each of the CE attributes, as well as the BAU option. As predicted by the model, the maps indicate that respondents are overwhelmingly positive towards peatland restoration in all sampled postcode areas. Only in very few locations the WTP is negative. Depending on the attribute considered, negative values are found only in few low-

[13] Note that because the means of the LVs are normalized to zero (with unit standard deviation), the main effects (means) can be readily interpreted as population means. This way, the interactions between the latent variables and the preference parameters allow for a direct comparison of the relative effects of each latent belief on preferences/WTP.

[14] Additional variables considered in the model, but not significantly contributing to explain the latent variables, include: education below university level, whether the person lives in a urban or rural area, and relatively low levels of engagement with outdoor recreation.

[15] In our survey, having asked for young children or grandchildren in a single question implies that respondents of all ages can answer affirmatively. This may contribute to the rather counter-intuitive finding of a negative relationship between having young (grand)children and environmental attitudes (Diamantopoulos et al., 2003).

Table 3
Structural component of the HMXL model with general environmental attitudes and place identity.

Structural component[a]		
	Dependent variable: LV_1 (positive general env. attitudes)	Dependent variable: LV_2 (strong place identity)
Age	−0.0814***	0.1658***
	(0.0293)	(0.0316)
Female	0.1127***	0.1451***
	(0.0279)	(0.0317)
University education (reference: secondary education up to 16)	−0.0007	−0.1187**
	(0.0444)	(0.0557)
Income above median (reference: income below median)	−0.1300***	0.0004
	(0.0282)	(0.0320)
Member of environmental organization	0.0979***	−0.0226
	(0.0296)	(0.0316)
Children or grandchildren below 16	−0.1163***	0.0610**
	(0.0286)	(0.0283)
Outdoor recreation – important (reference: not important)	0.1966***	0.1411***
	(0.0506)	(0.0529)
Outdoor recreation – very important (reference: not important)	0.3820***	0.3940***
	(0.0505)	(0.0553)
Previous visit to wild (peat) areas – once or twice (reference: never visited)	−0.0628**	0.1027***
	(0.0314)	(0.0346)
Previous visit to wild (peat) areas – several times (reference: never visited)	0.0141	0.2446***
	(0.0332)	(0.0369)
Previous visit to wild (peat) areas – live there (reference: never visited)	−0.0389	0.1065***
	(0.0284)	(0.0262)

Model diagnostics[b]	
LL at convergence	−33,797.9
LL at constant(s) only	−40,625.7
McFadden's pseudo-R^2	0.1681
Ben-Akiva-Lerman's pseudo-R^2	0.4948
AIC/*n*	6.0526
BIC/*n*	6.1473

[a] All explanatory variables in the structural component are normalized for zero mean and unit standard deviation.
[b] Further information on the model diagnostics included: *n* (number of observations) = 11,216; *r* (respondents) = 1,402; *k* (parameters) = 145.

density postcode areas,[16] accounting for less that 15% of the total population of Scotland. While respondents are generally supportive of peatland restoration, there is also a considerable degree of heterogeneity in the spatial patterns of WTP.

SP valuation often places a great focus on distance to the good being valued as a main driver of spatial heterogeneity in welfare estimates (Johnston and Ramachandran, 2014). However, when comparing the WTP maps with the map displaying peatland location (bottom right corner in Fig. 3) it emerges that there is no close match between preferences for the restoration of peatlands and the distance of respondents to these ecosystems. Hence, distance to the valued good does not seem to be the only driver of preferences in this case. Based on our model results, latent environmental attitudes and place identity beliefs (presented in Fig. 4) could in part explain the spatial heterogeneity of preferences. We investigate this issue by exploring the correspondence between the geographical distribution of WTP and the distribution of environmental attitudes and place identity scores across postcode locations (see Appendix 3). More specifically, we checked (at individual and postcode level) whether respondents having a WTP above (below) the average of the sample also display environmental attitudes and place identity beliefs above (below) the sample average, consistently with the conclusions drawn from the model results presented in Table 2. In addition, we also identified those cases (not aligned with the conclusions drawn from Table 2) where a WTP above (below) the sample average is associated with environmental attitudes or place identity beliefs below (above) the average. The results of this exercise, summarized through the maps reported in Appendix 3, indicate a mix of areas where WTP and environmental attitudes/place identity move in the same direction and areas where they appear to be negatively correlated. In most of the highly populated postcode areas, though, people with higher environmental attitudes and place identity tend to display WTP above the sample average, as predicted by our model. Overall, these findings suggest that general environmental attitudes and place identity might be relevant factors explaining the spatial heterogeneity of preferences.

5. Discussion

Environmental attitudes and place identity beliefs are among the most important drivers of pro-environmental behaviour, according to research in the field of environmental psychology and sociology (Carrus and Bonaiuto, 2005; Prati et al., 2015). However, these factors have received only limited consideration within the environmental SP valuation literature. Our study contributes to address this gap by investigating the influence of both environmental attitudes and place identity beliefs on preferences, in the framework of a DCE study focusing on the benefits of peatland restoration in Scotland. Our results, estimated through a robust econometric approach, show that both factors have a significant positive influence on people's WTP.

Our findings provide a richer understanding of preference heterogeneity and shed more light on the factors contributing to the support for (or opposition to) conservation policies. Based on our findings,

[16] Larger postcode areas have lower population density, while the population density is higher in smaller postcode areas (for a map of the population distribution across postcode districts in Scotland, we refer the reader to the supplementary material available online for this manuscript (Appendix 4)).

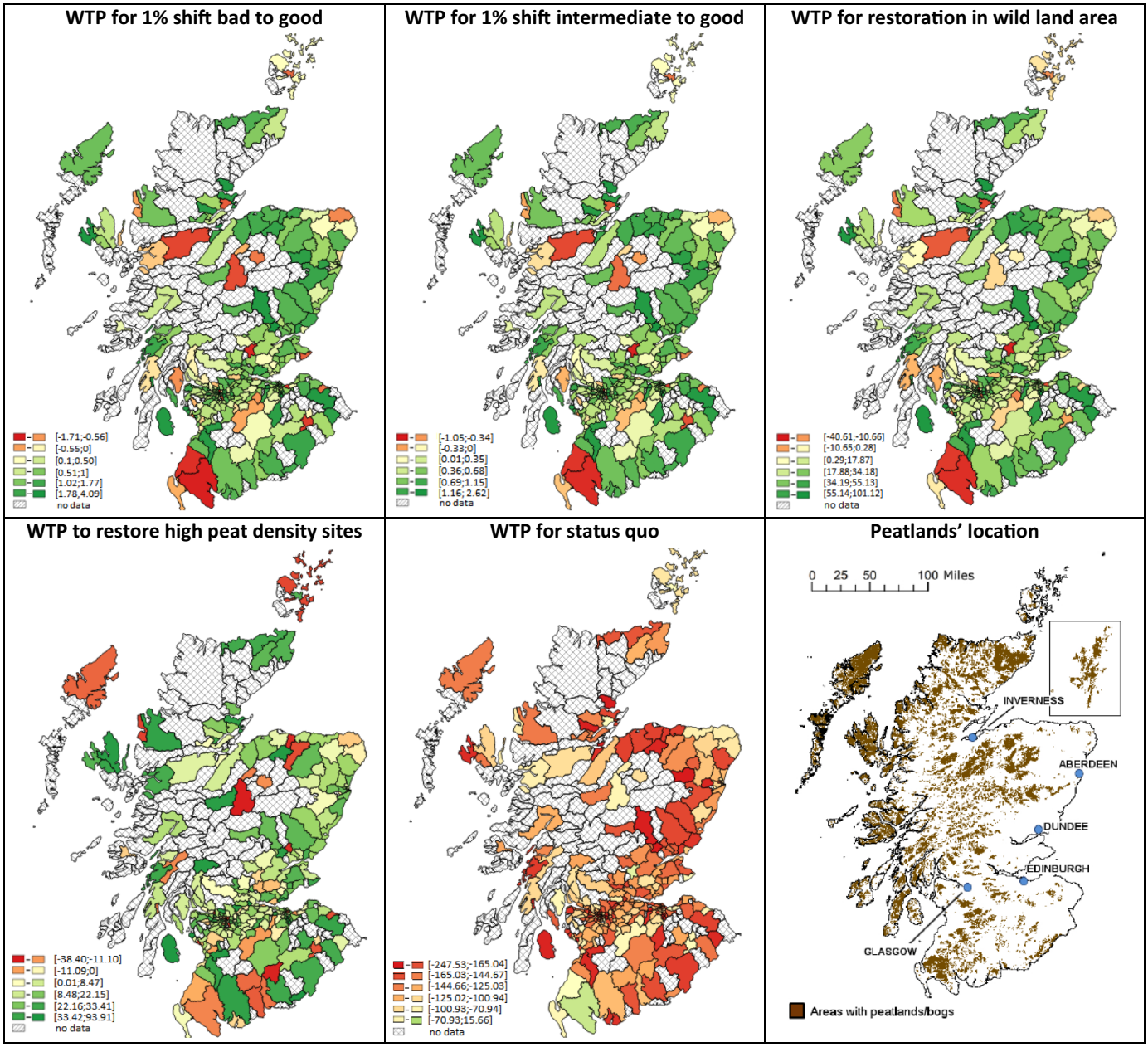

Fig. 3. Maps of willingness to pay (WTP) distribution (average by postcode, in GBP) and location of peatlands.
Note: The above maps of WTP were developed by using own data, as well as the UK Data Service Census Support boundary dataset. The following copyright statements apply: Postal Boundaries © GeoLytix copyright and database right 2018. Contains Ordnance Survey data © Crown copyright and database right 2018. Contains Royal Mail data © Royal Mail copyright and database right 2018. Contains National Statistics data © Crown copyright and database right 2018. The last map (bottom right corner) was developed in 2015 in collaboration with M. Aitkenhead, The James Hutton Institute, starting from data on soil carbon stocks. To the reader of the printed version of this article: please refer to the online manuscript for a colour version of Fig. 3.

lower levels of support for peatland restoration can be explained by lower levels of general environmental attitudes and/or lower identification with and attachment to the place. These results contribute to a wider discussion in environmental economics, and particularly within the SP literature, about the usefulness of psychological and sociological aspects to enrich the explanation of why the economic demand for environmental goods varies across people (Hanley and Czajkowski, 2019). A better understanding of preference heterogeneity is critical to generate more accurate welfare estimates to inform the design of environmental policies (Boxall and Adamowicz, 2002; Colombo et al., 2008; Torres et al., 2011). Our results are useful to better inform project appraisal, evaluate the welfare impacts of restoration policies and guide the implementation of conservation strategies.

Our study focuses on two psychological and sociological constructs (i.e. general environmental attitudes and place identity beliefs) that are relatively stable over time and deeply rooted in people's beliefs (Gatersleben et al., 2014). It is therefore expected that the effect of both constructs on preferences is long-lasting and stable. This is a desirable property, as general environmental attitudes and place identity beliefs can thus contribute to reinforce the fair-to-substantial stability of preferences found in previous test-retest SP studies (Rigby et al., 2016). Stable preferences are important for policy appraisal, especially when the design of longer-term policies is discussed. In fact, in the presence of stable preferences, a policy currently perceived as beneficial would likely continue to be perceived as desirable also in the future. On the other hand, relatively unstable constructs, which are susceptible to

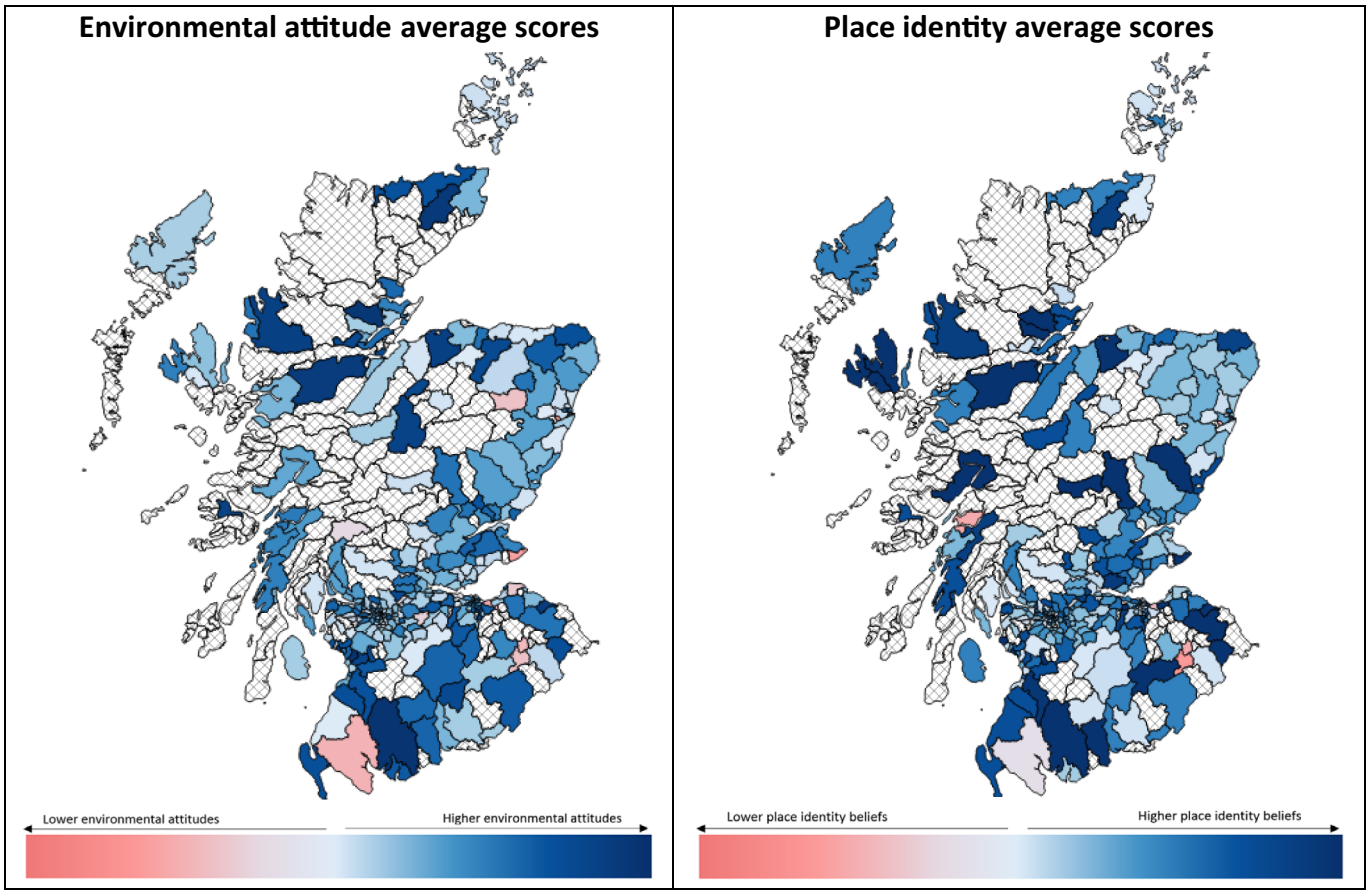

Fig. 4. Maps of the distribution of: i) environmental attitude scores and ii) place identity scores.
Note: The scores were created by calculating the individual-specific mean of the responses provided to the statements measuring general environmental attitudes and place identity, respectively. Indices were normalized for zero mean and unit standard deviation in the sample. The postcode areas with a crisscross pattern correspond to locations for which no observation was available from the survey. The above maps were developed by using own data, as well as the UK Data Service Census Support boundary dataset. The following copyright statements apply: Postal Boundaries © GeoLytix copyright and database right 2018. Contains Ordnance Survey data © Crown copyright and database right 2018. Contains Royal Mail data © Royal Mail copyright and database right 2018. Contains National Statistics data © Crown copyright and database right 2018. To the reader of the printed version of this article: please refer to the online manuscript for a colour version of Fig. 4.

change and could drive preference instability, are problematic from the perspective of project assessment. This discussion opens the door to further research on the role of psychological and sociological factors as potential drivers of preference stability (or shifts) over time. Previous literature on the temporal stability in stated preference studies in the environmental context (Liebe et al., 2012; Schaafsma et al., 2014; Czajkowski et al., 2016a; Brouwer et al., 2017) controlled, only in a rudimentary fashion, if at all, for the effect of attitudes and beliefs. The analytical approach used in our research could be applied to directly investigate this issue.

Knowing about preference heterogeneity additionally allows to better understand the distributional impacts of policies and gain more insights regarding who benefits most and who least, which is important for equity considerations in project appraisal. Our results have shown that certain socio-demographic groups (women, respondents with an income below the median for the sample, members of environmental organizations and individuals actively engaged in outdoor recreation) are more likely to benefit from peatland restoration because they tend to display higher general environmental attitudes and/or place attachment, which are related to more positive welfare measures. Moreover, we have also investigated how environmental attitudes, place identity beliefs and welfare measures are spatially distributed across different geographical locations. Our study shows that respondents' general environmental attitudes, place identity perceptions and WTP for peatland restoration are heterogeneously distributed across space, but follow somewhat correlated patterns. Our findings contribute to evidence that economic theory may sometimes offer only limited insights into explaining empirically established patterns of spatial welfare heterogeneity, as reviewed in Glenk et al. (2019a). Our results suggest that latent general environmental attitudes and place identity beliefs may help understanding seemingly idiosyncratic spatial welfare patterns. Our study points to the fact that aspects of distance to valued sites and spatial scope (quantity within distance; see Holland and Johnston, 2017), which are traditionally considered to be the main factors explaining spatial patterns of WTP, appear to be less prominent drivers. In fact, our respondents are willing to pay for the restoration of less accessible peatlands and areas with a greater density of peatlands, despite in most of cases living far away from these peat sites. Respondents in our sample seem to perceive Scotland and its natural environment also as a place with emotional and cultural meanings. More research is certainly needed in the future to deepen existing knowledge about the role of different (objective and subjective) spatial dimensions and explore their relative importance in the modelling of preferences.

6. Concluding remarks

Following the popularization of the notion of ecosystem services outside academia, there has been an increasing demand for the monetary valuation of the environment to justify, from a social perspective, policy efforts to counter environmental degradation. To appropriately

fulfil this knowledge demand, though, valuation needs to better represent and capture complex human preferences. To contribute to this goal, this study has explored, by means of a DCE application and a robust econometric approach, the role of two important factors that are expected to influence environmental preferences: general environmental attitudes and place identity beliefs. Through the simultaneous study of the significance, magnitude and relative importance of the effect of both aspects on WTP, this study enhances our understanding of preference heterogeneity, which provides more accurate preference and welfare measure estimates. This information allows to better guide the design of environmental policies and, in addition, it allows to better understand the distributional implications of policies (across e.g. space and socio-economic groups) for equity considerations in project appraisal.

Beyond environmental attitudes and place identity beliefs, other factors – such as social norms, people's awareness, subjective perceptions or cognitive elements – have only received scarce consideration by the valuation literature. This has been the case despite such factors being recognized as important drivers of values by environmental psychologists and sociologists. To address this gap, working more collaboratively with environmental psychologists and sociologists will be increasingly important to develop more solid frameworks of analysis and to design improved, as well as tailored, scales for measuring latent constructs, such as the ones considered in this study. A better understanding of the behavioural drivers of human preferences, though, necessarily also exposes the environmental valuation discipline to new challenges. First, a richer characterisation of the determinants of environmental preferences requires regularly collecting information about respondents' views regarding different psychological and sociological dimensions in SP surveys. Given budget (and survey length) restrictions, this can be a challenge. Second, to appropriately model information on preferences and attitudes/motivations/beliefs, increasingly advanced econometric tools would be required. However, these are not necessarily readily available in commercial statistical packages and not easy to use and interpret by most practitioners. In a context where reliable welfare estimates of environmental goods and services are increasingly needed to guide policy-making, it is critical that the above challenges are adequately acknowledged and addressed.

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Declarations of competing interest

None

Appendix 1. Descriptive statistics of the responses provided to the New Ecological Paradigm (NEP) scale and place identity statements.

NEP statements[a]

NEP statement	Completely disagree	Somewhat disagree	Somewhat agree	Completely agree
1. We are approaching the limit of the number of people the earth can support	4.80%	20.48%	46.88%	27.85%
2. Humans have the right to modify the natural environment to suit their needs (*reverse coded*)	5.13%	43.64%	38.95%	12.28%
3. When humans interfere with nature it often produces disastrous consequences	2.01%	11.38%	48.77%	37.83%
4. Human ingenuity will ensure that we do not make the earth uninhabitable (*reverse coded*)	7.76%	43.61%	39.48%	9.16%
5. Humans are severely abusing the environment	2.46%	10.38%	46.99%	40.18%
6. The earth has plenty of natural resources if we just learn how to develop them (*reverse coded*)	20.19%	55.88%	18.96%	4.96%
7. Plants and animals have as much right as humans to exist	1.23%	6.98%	42.07%	49.72%
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations (*reverse coded*)	4.52%	25.38%	48.41%	21.70%
9. Despite our special abilities humans are still subject to the laws of nature	0.45%	4.97%	53.10%	41.49%
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated (*reverse coded*)	5.35%	25.54%	41.49%	27.61%
11. The earth is like a spaceship with very limited room and resources	3.18%	25.17%	48.88%	22.77%
12. Humans were meant to rule over the rest of nature (*reverse coded*)	4.74%	24.44%	41.91%	28.91%
13. The balance of nature is very delicate and easily upset	0.89%	10.28%	52.18%	36.65%
14. Humans will eventually learn enough about how nature works to be able to control it (*reverse coded*)	5.59%	39.66%	40.56%	14.19%
15. If things continue on their present course, we will soon experience a major ecological catastrophe	3.18%	20.70%	49.11%	27.01%

[a] To force respondents to pay attention when replying to the questions and avoid random responses, the NEP scale is constructed in such a way that, for half of the statements agreement implies a pro-environmental attitude, while for the other half it indicates an anti-environmental attitude. In this table (and the rest of the paper) we reverse coded these latter statements (item 2, 4, 6, 8, 10, 12, 14), such that agreement with these suggests a pro-environmental attitude.

Place identity perceptions

Statements	Completely disagree	Somewhat disagree	Somewhat agree	Completely agree
I think peatlands are part of Scotland's identity	1.62%	8.64%	50.64%	39.10%
I have strong bonds with Scotland	2.01%	7.92%	32.74%	57.33%
I strongly identify with Scotland	2.46%	10.28%	30.56%	56.70%
I like to spend time enjoying the Scottish landscape of which peatlands are a very important part	2.34%	14.39%	44.62%	38.65%

Appendix 2. Socio-demographic characteristics of the sample compared to the overall Scottish population.

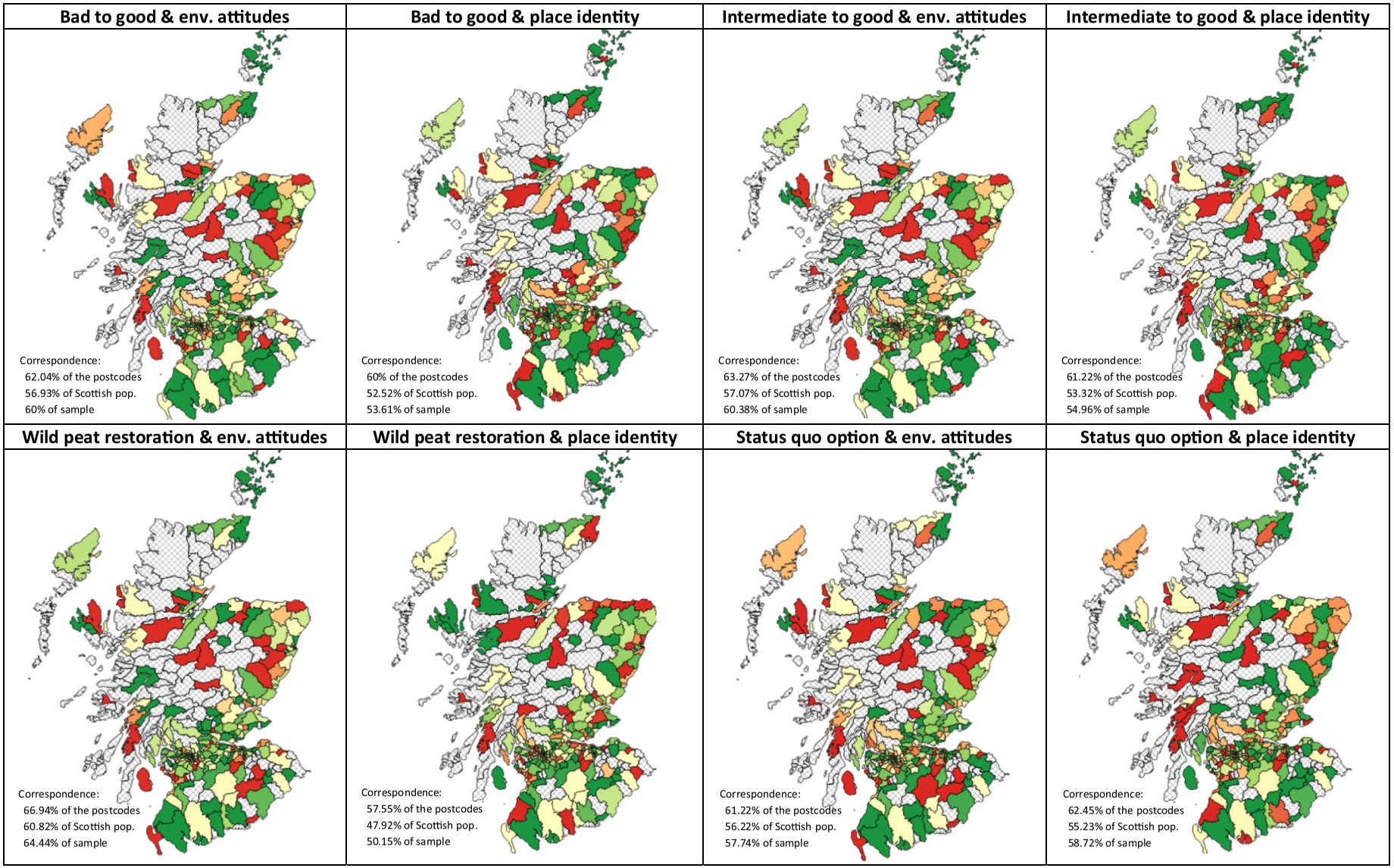
Variable	Sample	Overall population (Scotland)[a]
Gender distribution		
Female	50.3%	51%
Male	49.7%	49%
Age distribution (years old)		
18–24	6.8%	11.9%
25–44	36.2%	33.0%
45–64	34.7%	34.2%
≥ 65	22.3%	20.9%
Yearly household income		
GBP per year	£39,615	£38,337
Educational attainment (highest achieved Scotland census level)[b]		
Level 0	13.1%	26.8%
Level 1	20.8%	23.1%
Level 2	18.5%	14.3%
Level 3 and above	45.3%	36.0%
Prefer not to tell	2.4%	–
Social grade (employment-based)[c]		
Higher and intermediate	19.0%	19.0%
Supervisory, clerical, junior	43.2%	32.0%
Skilled manual	9.7%	22.0%
Semi-skilled, un-skilled	18.1%	28.0%
Prefer not to tell	8.3%	–
Average household size		
Persons per household	2.34	2.25
Urban/Rural population		
Urban	65.13%	69.9%
Rural	34.87%	30.1%

[a] Scotland Census (2011) by National Records of Scotland (http://www.scotlandscensus.gov.uk/).

[b] Population figures include the population of 16 years of age or older, while our survey includes respondents of 18 years of age or older. The under-representation of the lowest age range and education level is partly explained by differences in the lower age bound. Level 0 corresponds to 'lower secondary school', Level 1 to 'upper secondary', Level 2 to 'College', Level 3 and above to 'University'.

[c] Lower representation of lower levels of social grade might be explained by 'prefer not to tell' answers which are more likely to correspond to lower rather than higher social grades.

Appendix 3. Degree of correspondence between the geographical distribution of WTP and environmental attitudes, or place identity, scores



Note: Areas marked in pale to dark green indicate postcodes where there is a low to strong positive relationship (correspondence) between WTP and environmental attitudes or place identity beliefs, namely areas where the WTP is above (below) the sample average and environmental attitudes or place identity scores are also above (below) the average of the sample, in line with the results in the model presented in Table 2. Areas painted in orange to red indicate locations where there is a low to strong inverse relationship between WTP and environmental attitudes or place

identity beliefs, namely those cases where WTP above (below) the sample average is associated with environmental attitudes or place identity beliefs below (above) the average. In those orange to red areas, WTP and attitudes/beliefs move in opposite directions, differently from what our model predicts. To the reader of the printed version of this article: please refer to the online manuscript for a colour version of Appendix 3.

The maps reported in Appendix 3 were developed by using own data, as well as the UK Data Service Census Support boundary dataset. The following copyright statements apply: Postal Boundaries © GeoLytix copyright and database right 2018. Contains Ordnance Survey data © Crown copyright and database right 2018. Contains Royal Mail data © Royal Mail copyright and database right 2018. Contains National Statistics data © Crown copyright and database right 2018. Information on the percentage of population living in pale to dark green postcode areas (where there is correspondence, i.e. where WTP, environmental attitudes and place identity beliefs move in the same direction, as predicted in Table 2) was obtained by intersecting our data with official statistics on the number of residents by postcode, available from Scotland's Census 2011 - National Records of Scotland (Table KS101SC - Usual resident population by postcode) https://www.scotlandscensus.gov.uk/ods-web/data-warehouse.html#standarddatatab.

Appendix 4. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ecolecon.2020.106600.

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