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Are Chinese willing to pay for travel carbon offset products?

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ABSTRACT

This study explored tourists' preferences and willingness to pay for travel carbon offset (TCO) products using a hybrid choice model (HCM). This model integrates a mixed multinomial logit model (MMNL) and a latent variable model (LVM) to facilitate the exploration of preference heterogeneity among tourists by incorporating individual psychological constructs. The key empirical results were as follows: (1) the respondents were more likely to purchase a TCO product when they were provided with both TCO and opt-out options; the respondents were willing to pay ¥108 (about US$15.88) for an optimal TCO product for 1-tonne travel carbon emissions; (2) tourists' preferences for TCO products were influenced by offset- and travel-related factors, including offset quantity, project locations and types, TCO providers and payment time; and (3) green trust and socio-demographic characteristics influenced the respondents' preferences for TCO products. Through this study, we extend the literature on global warming mitigation, pro-environmental behaviour and discrete choice modelling. Our empirical results can be used by tourism businesses to understand tourists' demands for TCO products and to provide specific recommendations for developing decarbonisation products.

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Carbon offset; decarbonisation; discrete choice experiment; hybrid choice model; willingness to pay

Introduction

Given the reciprocal impacts of climate change on tourism, the tourism industry is experiencing global pressure to achieve carbon neutrality by 2050, as outlined in the Paris Agreement. Carbon offsets are defined as in-part or in-whole preventions of or reductions in carbon emissions elsewhere to offset the carbon emissions created by an activity, e.g. reductions are made in carbon emissions elsewhere to offset the carbon emitted by a plane trip (International Air Transport Association [IATA], 2022). Carbon offsets therefore enable individuals to take responsibility for their carbon footprint by investing in projects that mitigate emissions. In 2022, the global volume of voluntary carbon offsets issued was approximately 319.96 million tonnes, which represents offsets available for sale. This figure contrasts with the 179.81 million tonnes of retired offsets, which refer to carbon credits removed from circulation permanently to prevent double counting of emissions reductions in the carbon market (*The Voluntary Carbon Market*

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Dashboard, 2023). The issued and retired volumes are useful indices of supply and demand in the voluntary offset market, in which issuances usually exceed retirements. Officially introduced in July 2021, China's national emissions trading system is the largest emissions trading market in the world, with a coverage of about 4800 million tonnes of CO_2 equivalent emissions. This market is also set to increase as more industries are included. Since 2013, 287 China Certified Emission Reduction (CCER) projects have been registered in pilot carbon markets to reduce emissions *via* offsets. As of September 2019, a total of 202 million tonnes of CO_2 equivalent emissions had been traded in the Chinese emissions trading market (Slater et al., 2019).

Individual tourists can also contribute to tourism decarbonisation through voluntary carbon offsetting. By engaging tourists in carbon offset activities, it is possible to harness their collective impact and contribute to a more sustainable and climate-conscious tourism industry (Lovell et al., 2009). Although various offset supplies exist, limited sales have been seen in the tourism industry outside of aviation. The reason may be that there is a psychological distance between tourists and offset products (Higham et al., 2019; Ritchie et al., 2021). Due to the limited adoption of offset practices in the tourism industry and the barriers that exist between tourists and offsets, previous studies that have examined choice behaviour concerning carbon offsets and tourism have predominantly focused on carbon offsets associated with flying (Choi et al., 2018; Choi & Ritchie, 2014; Eijgelaar, 2011; Guix et al., 2022; Ritchie et al., 2021; Smith & Rodger, 2009; Zhang et al., 2019). However, the development of carbon offset mechanisms for tourism requires collective effort and cooperation across the whole tourism industry.

The development of travel carbon offset (TCO) products requires an in-depth understanding of tourists' preferences and choices. This study therefore explored whether tourists are likely to choose TCO products and what factors influence their choices. We conducted a discrete choice experiment (DCE) in which the participants were presented with a hypothetical scenario involving a choice set of TCO options.

This study makes three novel contributions to the literature. First, we propose a new possibility for industry-wide TCO products and calculate the economic value of each TCO attribute, which provides a starting point for future carbon offset and tourism studies. Second, we integrate offset- and travel-related attributes and "green trust" into a single framework to extend our understanding of the key factors that influence tourists' preferences for TCO products. Third, by introducing a latent variable to explore the influence of green trust on tourists' preferences for TCO products, we demonstrate how a hybrid choice model (HCM) that combines a mixed multinomial model (MMNL) and latent variable model (LVM) can be applied in the tourism field. Our findings therefore provide an up-to-date reference for carbon pricing and the development of TCO mechanisms.

Literature review

Preferences for TCO products

The adoption of the Kyoto Protocol by the United Nations Framework Convention on Climate Change (UNFCCC) in 1997 and the subsequent development of the carbon market have led to many studies of voluntary carbon offsets in the tourism literature. Acquiring carbon offsets not only contributes to curbing global climate change but also yields noteworthy individual benefits (i.e. utility). The initial focuses of these studies have primarily been the potential of carbon offsets (Dhanda, 2014; Eijgelaar, 2011; Hyams & Fawcett, 2013; Watt, 2021) and the factors that influence consumers' choice of carbon offsets (Brouwer et al., 2008; Choi et al., 2018; Choi & Ritchie, 2014; Gössling et al., 2007, 2009; Lim & Yoo, 2014; Lu & Shon, 2012; Ritchie et al., 2021; Rotaris et al., 2020; Schwirplies et al., 2019; Smith & Rodger, 2009). For example, Choi and Ritchie (2014) included carbon emissions, the types of offset projects, airline measures and price in a DCE and found significant relationships between these attributes and travellers' preference for products to offset flying. Rotaris et al. (2020) also conducted an online survey using a DCE with

998 Australians and found that air travellers preferred to purchase domestic air carbon offsets that were accredited, administered by a non-profit organisation and contributed directly to carbon reduction in the destination. Schwirplies et al. (2019) considered carbon offsets for different travel modes (e.g. plane and bus) based on a DCE with 1000 individuals from Germany and found that compensation locations, project types, contributions from providers and the cost of carbon offsets significantly influenced tourists' choice to offset their CO_2 emissions.

Researchers have also explored ways to improve communication with tourists and to increase their offsetting behaviours and influence their choices (Babakhani et al., 2017; Denton et al., 2020; Guix et al., 2022; Segerstedt & Grote, 2016; Zhang et al., 2019). However, the majority of studies investigating the factors influencing tourists' offsetting behaviours have predominantly concentrated on air transport, with limited research on TCO products throughout the broader tourism industry. To address this research gap and meet our research objective, we developed a hypothetical TCO product combining travel characteristics and carbon offset projects based on previous studies of carbon offsets for flying, including CO_2 offset contributions, project locations, project type, offset product provider, offsets from product provider, payment time and offset price (Brouwer et al., 2008; Choi et al., 2018; Choi & Ritchie, 2014; Gössling et al., 2007, 2009; Lim & Yoo, 2014; Lu & Shon, 2012; Ritchie et al., 2021; Rotaris et al., 2020; Schwirplies et al., 2019; Smith & Rodger, 2009) and the attributes of tourism products (Hao et al., 2022; Pröbstl-Haider & Haider, 2014; Schaafsma & Brouwer, 2020; Seekamp et al., 2019; Sriarkarin & Lee, 2018; Ulrike et al., 2015).

Economic value of TCO products

Willingness to pay (WTP) is the maximum amount of money a consumer is willing to pay to obtain a product, service or improvement in their current circumstances. Encouraging tourists to take responsibility for their carbon emissions requires understanding whether tourists are willing to pay for carbon mitigation. A vast literature has documented a considerable demand for carbon offsets among tourists. Table 1 summarises the literature on WTP for carbon offsets in the tourism industry. Brouwer et al. (2008) conducted a survey of air travellers at Amsterdam Schiphol Airport and used a contingent valuation method (CVM) to identify an average WTP of €23 to offset carbon emissions from flying. In a survey of over 1000 air travellers from Taiwan conducted using a CVM, Lu and Shon (2012) found significant WTP means of US$5, US$8.8, US$10.8, and US$28.6 for carbon offsets for flights to mainland China, northeast America, Southeast Asia, and Western destinations (including Frankfurt, Germany; Paris, France; London, United Kingdom; Los Angeles, United States; and Sydney, Australia), respectively. Calculated by the ratio of coefficients between non-monetary attributes and price from a discrete choice model (DCM), Choi and Ritchie (2014) found a mean WTP of AU$21.38 to reduce 1 tonne of CO_2 through a carbon offset project. Ritchie et al. (2021) investigated Australian travellers and found that they were willing to pay AU$166 for an optimal carbon offset product that had all of the most desirable attributes and that offset 25% of emissions from their air trip. Using a DCE, Rotaris et al. (2020) found that the WTP for offsetting per tonne of CO_2 emissions ranged from €12 to €38 among air travellers from Italy. Given this evidence, we propose the following hypothesis:

Hypothesis 1: Tourists have a significant and positive WTP to offset carbon emissions.

Latent variable and preferences for carbon offsets

"As a hypothesis regarding future behaviour, a hypothesis certain enough to serve as a basis for practical conduct, confidence is intermediate between knowledge and ignorance. The person who knows completely need not trust" (Simmel & Wolff, 1950, p. 318). Due to the intangibility and complexity of the offsetting process, markets exist between the knowable and unknowable

Table 1. Summary of WTP for voluntary carbon offset in tourism.

Study (year)	WTP	Payment	Methods (Models)	Sample	Setting
Brouwer et al. (2008)	€23	Per flight	CV	Travelers at Dutch airport	Airline
MacKerron et al. (2009)	£24	Per flight	CV and DCE (MMNL)	UK residents	Airline
Lu & Shon, 2012)	US$5–US$28.6 for flights to mainland China, northeast America, southeast Asia, and Western countries	Per flight	CV	Taiwanese air travelers	Airline
Choi & Ritchie (2014)	AU$21.38	Per ton	DCE (MMNL)	University students/ staff	Airline
Lim & Yoo (2014)	KRW 1,345 (US$1.24)	Per trip	CV	Train travel passengers in Korean	Train travel
Choi et al. (2018)	AU$12.27 for domestic flights and AU$0.92 for international long-haul flights	Per ton	DCE (MMNL)	Australian residents	Airline
Schwirplies et al. (2019)	€250 for trips by bus and €40 for trips by plane	Per trip	DCE (MMNL; LCM)	German residents	Different transportations context
Rotaris et al. (2020)	€12–€38 €14–€66	Per ton Per flight	DCE (MNL; MMNL)	Italian air travelers	Airline
Ritchie et al. (2021)	AU$166	Optimal program	DCE (LCM)	Australian residents	Airline

Note: CV: contingent valuation; DCE: discrete choice experiment; LCM: latent class model; MML: multinomial logit model; MMNL: mixed multinomial logit model.

aspects of offsetting, which indicates that consumers need trust to make decisions about offsetting.

The effectiveness of carbon offsets in mitigating climate change has been a topic of ongoing debate since the creation of carbon offsetting (Badgley et al., 2022; Becken & Mackey, 2017; Hyams & Fawcett, 2013; Watt, 2021). Offsets must reflect climate benefits that surpass what would typically occur under business-as-usual circumstances, adhering to the principle of additionality (Badgley et al., 2022). Although offsets' additionality is a fundamental prerequisite to their successful inclusion in climate policy, this standard is not always achieved in practice (Becken & Mackey, 2017). The scepticism and hesitance exhibited by the public towards the credibility, effectiveness and integrity of carbon offset measures have increased in line with a series of greenwashing cases, such as a lawsuit against Dutch airline KLM in 2022 (Thomas, 2022). This lack of trust has posed major challenges to the implementation and overall success of various carbon offsetting initiatives (McNish, 2012; Watt, 2021), prompting the need for increased research on trust in tourism decarbonisation.

The literature proposes various definitions of trust. For example, Rousseau et al. (1998) defined trust as "the intention to accept vulnerability based on positive expectations of the intentions or behaviours of another" (p. 395). Trust arises from the belief in trustees' integrity, benevolence and ability (Ganesan, 1994; Schurr & Ozanne, 1985). In the context of environmentally conscious products, Chen (2010) established the concept of "green trust" as an individual's "willingness to rely on a product, service, or brand due to the belief or expectation derived from its credibility, benevolence, and ability regarding environmental performance" (p. 309).

In addition to a good's observed attributes, latent psychological inclinations are crucial in influencing consumer behaviour. Models recognising the role of psychological inclinations in choice behaviour have become increasingly popular in the transportation and forestry fields (Atasoy et al., 2013; Daly et al., 2012; Ouvrard et al., 2020; Prato et al., 2012; Temme et al., 2008), and several have been applied to the tourism field in recent years (Albaladejo & Díaz-Delfa, 2021; Hao et al., 2022; Lindberg et al., 2019; Masiero & Hrankai, 2022; Masiero & Qiu, 2018; Xie et al., 2019). Green trust, which represents a consumer's confidence in the environmental claims and actions of a product or service provider, plays a pivotal role in shaping individuals' decisions related to their carbon offset choices. Studies have demonstrated the positive influence of trust on consumers' purchasing intentions or behaviours (Charness & Rabin, 2002; Ranaweera & Prabhu, 2003; Sung et al., 2021). However, businesses have overstated or even fabricated the environmental performance of their green products, leading to customer distrust of the green market (Chen, 2010; Kalafatis et al., 1999). Chen (2010) pointed out that green trust influenced customers' purchasing decisions for green products, and tourism research has consistently indicated that green trust has a positive influence on people's pro-environmental behaviours and intentions (Chen & Chang, 2012; Chuah et al., 2020). In a study on greenwashing in the hotel industry, Chen et al. (2019) found significant and positive relationships between guests' green trust and their revisit intention, intention to engage in green practices and word of mouth. Schwirplies et al. (2019) found that individuals who believed in the effectiveness of carbon offsets for climate mitigation were more likely to pay for carbon offsets. Considering these insights, we propose the following hypothesis:

Hypothesis 2: Green trust concerning carbon offsets positively influences the probability of choosing a TCO product.

Green trust is a by-product of prior experience. Expectations regarding trustees' intentions or behaviour are based on information provided by an individual's past experiences (Burt & Knez, 1995). People attribute conditional probability to the outcomes of actions based on prior experiences (Boneau, 1974). For example, Lee and Mjelde (2007) found that people who had previously visited the Korean demilitarised zone in South Korea were more likely to donate to its preservation than those who had never been there. Lu and Shon (2012) found that tourists would pay less to offset their carbon emissions from flying if they knew nothing about offsetting.

Hypothesis 3: People with carbon offset experience are more likely to offset their carbon emissions than people without such experience.

In addition, many studies on pro-environmental behaviour have found that individuals' psychological inclinations and willingness to take action are correlated with age, gender, educational attainment and income, among other demographic characteristics (Juvan & Dolnicar, 2017).

Consumer behaviour diverges based on gender, primarily attributed to distinct roles within cultural and social settings (Kim et al., 2012). There is a notable influence of gender on the consumption patterns of sustainable products. Broadly, women tend to exhibit greater preferences for sustainable products than men (Costa Pinto et al., 2014).

Income has been widely acknowledged as a significant predictor of the adoption of innovative products (Oliveira & Dias, 2019). Income is anticipated to exhibit a positive correlation with the adoption of new products, as higher levels of income help alleviate resistance stemming from the higher prices of these products (Tellis et al., 2009). Moreover, consumers with higher income levels are likely to demonstrate greater environmental consciousness than those with lower income levels, as their financial capacity enables them to more easily absorb the high costs associated with adopting eco-friendly products (Straughan & Roberts, 1999).

In addition, single individuals may prioritise personal convenience or cost-effectiveness, and unemployed individuals may emphasise cost considerations, thereby influencing their preferences concerning the purchase of sustainable products (Oliveira & Dias, 2019).

In terms of carbon offsetting, Choi and Ritchie (2014) found that female travellers were more likely than male travellers to be carbon offsetters using cross-tabulation and logit regression. Rotaris et al. (2020) found that air travellers' gender, education level and occupation status significantly influenced their choice of carbon offsets for flights. They identified three types of carbon offsetters using a latent class model (LCM) and found that the segments significantly differed in age, marital status and employment status. Using MMNL and LCM to analyse DCE data from Germany, Schwirplies et al. (2019) found that respondents who were younger, female and with higher incomes were more likely to offset their travel-related emissions than other respondents. We therefore propose the following hypothesis:

> **Hypothesis 4:** Tourists' gender, income level, marital status and employment status significantly influence their choice of TCO products.

Methodology

Survey design

To explore the respondents' preferences for TCO attributes, we designed a DCE method based on a hypothetical scenario in which tourists were asked to choose from possible TCO options consisting of six attributes. Based on the aforementioned literature, relevant existing practices and our research objective, we selected these attributes and levels by integrating carbon offset characteristics into tourism products. Table 2 provides the attributes and their levels. The first attribute, CO_2 offset contribution, refers to the potential reduction in tourists' carbon emissions that can be achieved through TCO products. Carbon emissions can be offset either partially (50%) or entirely (100%) based on the amount of CO_2 emissions produced by a journey. To achieve this reduction in carbon emissions, individuals can engage in various types of carbon offset projects. In this study, we included four main types of carbon offset projects, which were implemented in specific locations (Chapman, 2020; Raffaelli et al., 2022). According to the analysis of global voluntary carbon offset market transaction volumes from 2005 to April 2018 (Hamrick & Gallant, 2018), the five main project types were reforestation, environmental conservation,

Table 2. Attributes and attribute levels of TCO products.

Attribute	Description	Levels
CO_2 offset contribution	You can choose to offset 50% or 100% of the carbon emissions caused by your travel	50% 100%
Project location	The projects may be implemented in your home country, your overseas destination or a developing country	Domestic Overseas destination Other developing countries
Project type	Reforestation and conservation projects absorb CO_2 through afforestation and forest protection Renewable energy projects include building solar, wind, or hydro sites Community projects help to introduce energy-efficient technologies to undeveloped communities Waste-to-energy projects capture carbon and convert it into electricity	Reforestation and conservation projects Renewable energy projects Community projects Waste-to-energy projects
Offset product provider	You can choose to buy the carbon offset product through an intermediary, including airlines, hotels and online travel agencies or buy it directly from the companies/organisations implementing carbon offset projects	Airline as the intermediary Hotel as the intermediary Online travel agency as the intermediary Directly provided by a carbon offset company/organisation
Contribution from product provider	The amount by which the product provider increases the amount of CO_2 offset	0% (0 kg) 50% increase 100% increase
Payment time	When you pay for carbon offsets	Before departure On-site After travel
Carbon offset price	The price you must pay to offset 100 kg of carbon emissions	¥5/100 kg ¥20/100 kg ¥35/100 kg ¥50/100 kg

renewable energy, community initiatives, and waste-for-energy. These project types have been incorporated into flying offset choice cards developed in past studies (Blasch & Farsi, 2014; Choi et al., 2018; MacKerron et al., 2009; Raffaelli et al., 2022; Ritchie et al., 2021; Rotaris et al., 2020). In a tourism context, source countries or regions and destinations are the most relevant project locations for tourists who want to offset their carbon emissions. Following Choi and Ritchie (2014), we included these location choices in our TCO framework. We also included other developing countries as potential project locations because most reforestation offset projects are in these countries (Wissner et al., 2022). This decision was influenced by our consideration of the broader impact of offset initiatives on sustainable development in these developing countries beyond carbon mitigation. To account for the unique product characteristics of both tourism and carbon offsetting, we included offset organisations as direct providers and airlines, travel agents and hotels as possible intermediaries identified by their "provider" attribute. We also considered the responsibility of these providers and their potential contributions to reducing carbon emissions by incorporating their additional offset quantity into the TCO products. To explore potential payment approaches for TCO, we included three main payment options: paying before departure, paying on-site or paying after travel. The first two options constitute the primary transactions for travel services, whereas payments after travel could facilitate an accurate calculation of travel-related emissions. In addition, we established four levels for the monetary attribute (¥5, ¥20, ¥35 and ¥50 per 100 kg) that reflect the range of carbon prices in carbon markets across China and Europe (Ember, 2022; State Council of People's Republic of China, 2022). In this experiment, all additional TCO product attributes were assumed to be the same.

Our survey included four sections. In the first section, we collected the respondents' past travel experiences. Based on their responses to the first section, in the second section, we conducted a DCE by presenting the respondents with a hypothetical scenario in which they had booked a trip through an online travel agency. In this scenario, the respondents found "low-carbon travel" options displayed on the website and they could choose to purchase a TCO product to offset the carbon emissions of their upcoming travel. We provided the respondents with eight choice sets and asked them to choose one option among two carbon offset options ("A" and "B") and one opt-out option ("none") for each choice set. Figure 1 shows an example of the choice set.

To investigate the effect of the latent variable on the respondents' carbon offset choices, we used a 7-point Likert scale (1= strongly disagree to 7= strongly agree) in the third section to measure their level of green trust (Chen et al., 2019; Sung et al., 2021). In the concluding section, we collected information on the respondents' gender, age, educational attainment, annual income, current occupation and marital status.

	Option A	Option B	None of them
CO2 offsetting contribution	Offsetting 880kg carbon emissions	Offsetting 440kg carbon emissions	/
Project location	Domestic	Overseas destination	/
Project types	Reforestation and conservation	Renewable energy	/
Offset product providers	Hotel as the middleman	Online travel agency as the middleman	/
Contribution from product providers	Offsetting 880kg carbon emissions	Offsetting 0kg carbon emissions	/
Payment time	On-site	After travel	/
Carbon offset price	￥176	￥154	/
Which option would you choose?	□ A	□ B	□ None

Figure 1. Choice set sample.

Data collection

We employed a professional market research company to conduct the survey online. The sampling frame was this company's audience network, which covers 7,889,310 unique respondents in mainland China with a relatively balanced distribution by city tier, age, gender and income. The company stratified the available samples based on the set quotas (i.e. balanced gender and age) and then applied random sampling to pull out samples and send out survey invitations. Before conducting the main survey, we conducted a pilot study with 150 participants to measure the determinant efficiency (D-efficiency) of our design and ensure the clarity of the survey and the realism of the scenario. A D-efficient design is a kind of experimental design that optimises the information gained from respondents' choices while minimising the number of choice sets presented to them. A minimum D-error was generated using Ngene (v. 1.3; ChoiceMetrics, 2021) with three blocks that each included eight choice sets. Each choice set included two alternatives and one opt-out option. We also confirmed that the design had no single alternative choice that dominated the other choices. The main survey was then distributed to 1571 respondents in January 2023, but more than half of the respondents did not finish or failed to pass the screening questions (i.e. the respondents who had not travelled abroad for leisure purposes during the previous 5 years, who would not like to travel overseas in the coming year or who did not understand carbon offsetting after reading the description were screened out). After screening, a total 900 useful responses (57.29%), including 7200 choice observations, were included in our data analysis. Table 3 shows the characteristics of the sample. The respondents were spread across a broad demographic: 48.2% were women, 46.2% were 18–39 years old, 10.9% were 60 years old or older, 14.4% had a master's degree or higher, 23.5% had an annual household income of ¥144,000 or less, 24.2% had an annual household income of ¥420,000 or more, 0.6% were unemployed and 11.8% were single. In the last 5 years, more than half of the respondents travelled overseas 1–3 times, more than 90% spent 1–2 weeks on their trip and more than half spent ¥20,000–¥40,000 on their holiday. In addition, 65.6% of the respondents indicated that they had paid for carbon offsets before and in 95.2% of the cases ($8 \times 900 = 7200$) the respondents chose opt-in carbon offsets. Figure 2 shows the respondents' reasons for purchasing or not purchasing carbon offsets in the past. For example, 62.2% of the respondents with offset experience stated that they paid for carbon offsets out of a sense of responsibility, followed by their awareness of the related information (51.7%) and trust in the companies, organisations or offset projects (50%) (Respondents could choose multiple answers). Meanwhile, about three quarters of the respondents without offset experience stated that there were no available carbon offset options. This number of responses was more than 50% higher than the number of respondents who preferred to save their budget or did not trust offset projects and their providers. In addition, the mean values of all indicators for green trust exceeded 5 ("somewhat agree") (see Table 6).

HCM

We used an HCM that integrated a DCM (i.e. an MMNL) and an LVM to generate estimates of the parameters of the models. Hybrid models have been widely used in studies of mode or route choices (Atasoy et al., 2013; Kim et al., 2012; Prato et al., 2012; Temme et al., 2008) and contactless hospitality choice (Hao et al., 2022). The MMNL model allowed us to capture the heterogeneity of preferences, while the LVM was used to explain the value of individual psychological constructs. The combination of MMNL and LVM in an HCM created a unified framework that enhanced the robustness and functional richness of the choice model (Hess & Daly, 2014). This approach allowed for the exploration of preference heterogeneity among tourists through

Table 3. Characteristics of the respondents ($N = 900$).

Characteristic		%
Gender	Female	48.2
	Male	51.2
	Other	0.6
Age	18–29	16.1
	30–39	30.1
	40–49	26.4
	50–59	16.4
	≥ 60	10.9
Educational attainment	Secondary education	4.8
	Further education	6.7
	Bachelor's degree	74.1
	Master's degree	12.0
	Doctoral degree	2.4
Annual individual income	< ¥36,001	3.4
	¥36,001–144,000	20.1
	¥144,001–300,000	32.4
	¥300,001–420,000	19.8
	¥420,001–660,000	13.2
	¥660,001–960,000	7.0
	≥ ¥960,001	4.0
Occupation	Student	2.6
	Frontline employee (private or public sector)	6.8
	Junior manager/executive (private or public sector)	31.1
	Senior manager/executive (private or public sector)	30.7
	Educator/researcher	2.8
	Professional (e.g. doctor, lawyer, writer, journalist)	13.4
	Self-employed (including housewife/husband)	5.9
	Unemployed	0.6
	Retired	6.2
Marital status	Single	11.8
	Married with child(ren)	81.0
	Married with no children	6.0
	Separated	0.9
	Other	0.3
Overseas leisure travel experiences in the last 5 years		
Visitation history	Once	13.4
	2–3 times	43.7
	4–5 times	17.3
	6–10 times	15.4
	> 10 times	10.2
Trip duration	1–3 days	2.3
	4–6 days	21.1
	7–9 days	39.2
	10–12 days	20.3
	13–15 days	11.2
	> 15 days	5.9
Latest flight duration	< 7 h	28.6
	7–9 h	35.0
	10–12 h	27.8
	> 12 h	8.7
Average tourism expenditure	< ¥10,001	3.3
	¥10,001–¥20,000	15.0
	¥20,001–¥30,000	23.1
	¥30,001–¥40,000	29.0
	¥40,001–¥50,000	17.6
	> ¥50,000	11.9
Carbon offset experience	Yes	65.6
	No	34.4
Options in DCE	Option A/B	95.2
	Opt-out	4.8

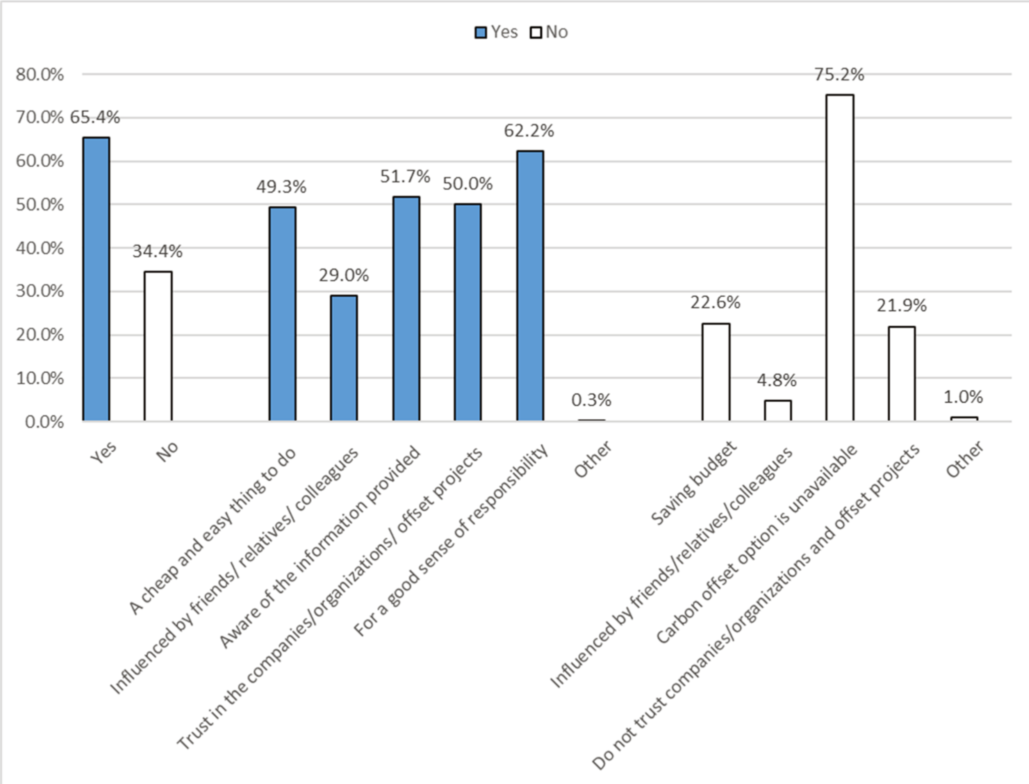

Figure 2. Respondents' carbon offsetting experiences.

the incorporation of individual psychological constructs. Figure 3 presents the methodological framework of this study based on the HCM.

The theoretical foundation of discrete choice modelling is random utility theory, which posits that people generally choose what they prefer, and when they do not, this can be explained by random factors (McFadden, 1974) and by Lancaster's (1966) characteristic framework, according to which the attributes of a good or service determine the utility that consumers derive from it. The structural and measurement components of the DCM are described below (Morley, 1992):

$$U_{i,j} = V_{i,j} + \varepsilon_{i,j} \tag{1}$$

$$V_{i,j} = \begin{cases} \sum_{k=1}^{K} \beta_{i,k} X_{i,k}, j = 1 \text{ or } 2 \\ ASC_i + \lambda^L LV_i, j = 3 \end{cases} \tag{2}$$

$$y_{i,j} = \begin{cases} 1, \text{if } U_{i,j} \geq U_{i,n} \forall n \in C_i \\ 0, \text{otherwise} \end{cases} \tag{3}$$

where $U_{i,j}$ is the utility of tourist i choosing alternative j (i.e. the TCO option), $V_{i,j}$ is the utility function's deterministic component and $\varepsilon_{i,j}$ is the unobserved independent and identically distributed extreme value error term. If tourist i chooses alternative $j=1$ or $j=2$, $X_{i,k}$ is a vector of the observed attribute k ($K=6$) describing the TCOs. $\beta_{i,k}$ are random parameters used to measure tourists' preference heterogeneity, which is assumed to be normally distributed for TCO

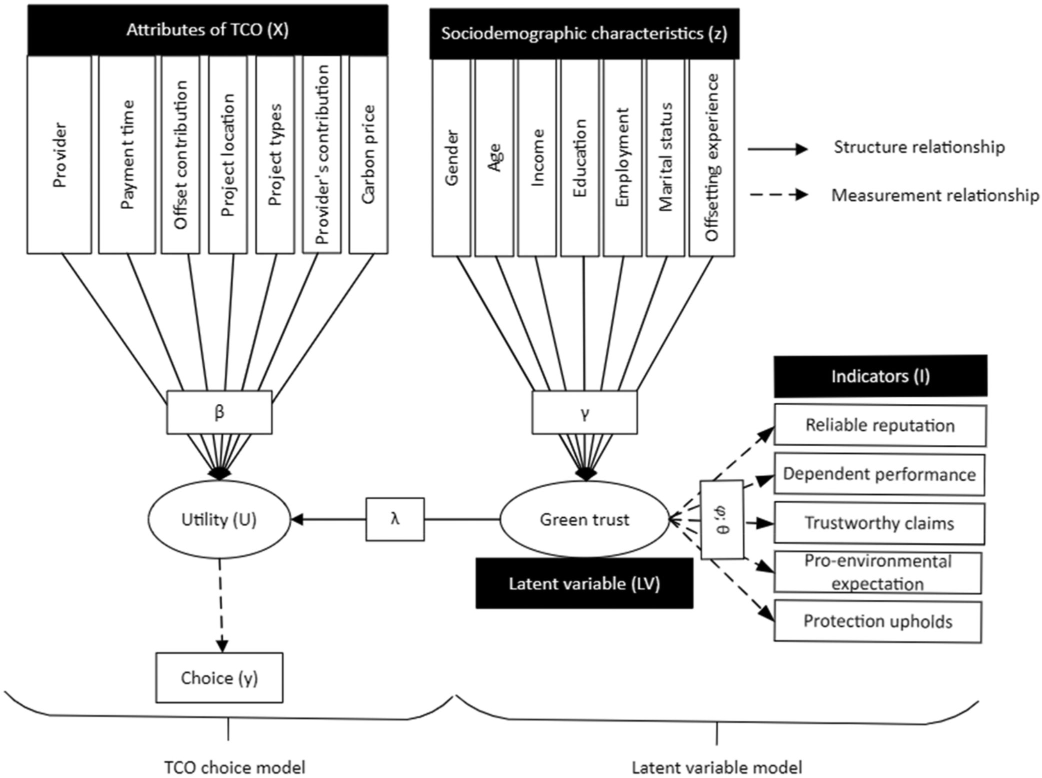

Figure 3. Methodological framework.

attributes. ASC_i is an alternative specific constant representing tourists' preference for the opt-out option (alternative j). LV_i is the latent variable. λ^L denotes an individual's preference heterogeneity. $y_{i,j}$ equals 1 if respondent i chooses alternative j, and 0 otherwise. Finally, C_i is the choice set of individual i.

The latent variable (LV_i), which indicates the underlying psychological characteristic of the respondents (i.e. green trust), is normally distributed. In the LVM, the latent variable is treated as an explanatory variable in the utility functions of choice alternatives (Ben-Akiva et al., 2002). The structural and measurement equations of the LV component are described as follows:

$$LV_i = \gamma z_i + \eta_i \tag{4}$$

$$I_{i,q} = \begin{cases} 1 & \varphi_{q0} \le \theta_q LV_i < \varphi_{q1} \\ 2 & \varphi_{q1} \le \theta_q LV_i < \varphi_{q2} \\ \vdots & \vdots \\ S & \varphi_{q(S-1)} \le \theta_q LV_i < \varphi_{qS} \end{cases} \tag{5}$$

where z_i is a vector representing the socio-demographic variables (i.e. gender, age, income, education level, occupation, marital status and employment status) and carbon offset experience variable of individual i, γ is a vector of estimated parameters capturing the impact of these variables on LV_i, η_i is the random error term following a standard normal distribution, $I_{i,q}$ denotes the observed ratings of the indication question q of the latent variable, φ_{qS} is the parameter associating the latent variable with the ratings from the S-point scale (S = 7) and θ_q represents the scale coefficient regarding the attitudinal questions.

The hybrid model can be estimated using maximum simulated likelihood. The choice probability conditional on the carbon offset attributes is expressed as follows:

$$P_y(y_i \mid X_{i,k}, LV_i; \beta_{i,k}, \lambda^L = \frac{\exp(U_{i,j})}{\sum_{k \in C_n} \exp(U_{i,k})}. \tag{6}$$

The probability of predicting the vector of indicators is given by the following ordered logit model (Hess & Palma, 2019):

$$P_{I_{i,q}}\left(I_{i,q} \mid LV_i; \varphi, \theta\right) = \sum_{s=1}^{S}\left(I_{i,q} = s\right)\left[\frac{\exp\left(\varphi_{qs} - \theta_q LV_i\right)}{1 + \exp\left(\varphi_{qs} - \theta_q LV_i\right)} - \frac{\exp\left(\varphi_{q,s-1} - \theta_q LV_i\right)}{1 + \exp\left(\varphi_{q,s-1} - \theta_q LV_i\right)}\right]. \tag{7}$$

The joint likelihood function that integrates the probability of observing choice and latent indicators is then expressed as follows:

$$LL_i\left(y_i, I_{i,q} X_{i,k}; \beta_{i,k}, \lambda^L, \eta, \varphi, \theta\right) = \int_{\eta}\int_{\beta} P_y(y_i \mid X_{i,k}, LV_i; \beta_{i,k}, \lambda^L P_{I_{iq}}\left(I_{i,q} \mid LV_i; \varphi, \theta\right) f_{\beta}\left(\beta_{i,k}\right) f_{\eta}\left(\eta_i\right) d\beta d\eta. \tag{8}$$

WTP indicates the substitution effects between non-monetary and monetary attributes (Choi, 2020; Masiero et al., 2015; Sriarkarin & Lee, 2018) and is the ratio of the mean coefficient of attribute l (β_l) and price (β_p), described by Equation (9):

$$WTP = \frac{MU_l}{MU_p} = -\frac{\beta_l}{\beta_p}. \tag{9}$$

Results and discussion

Choice model performance

We used the Apollo package in R (Hess & Palma, 2019) to estimate the DCMs. Table 4 presents the performance of the HCM, benchmarked with the multinomial logit (MNL) and MMNL models. The results for the choice components' likelihood, Akaike information criterion and Bayes information criterion showed that the HCM with the highest log-likelihood value performed the best.

TCO choice model results

As the choice component of the HCM outperformed the MNL and MMNL, we focus on the HCM results (see Table 5) in this section.

Table 4. Performance of choice models.

	MNL	MMNL	HCM
Log-likelihood (choice)	−5972.92	−5261.96	−5089.58
AIC (choice)	11,973.84	10,577.92	10,233.16
BIC (choice)	12,070.19	10,763.73	10,418.97

Note: AIC: Akaike information criterion; BIC: Bayesian information criterion; HCM: hybrid choice model; MNL: multinomial model; MMNL: mixed multinomial model.

The utility of the third alternative (i.e. "not offsetting your travel emissions") was given by the constant, the result of which indicated that the respondents were more likely to purchase TCOs than to opt out (−2.796, $p < 0.01$). This study further explored the determinants of tourists' TCO choice. A positive (negative) sign on a significant coefficient implied that the respondents preferred (did not prefer) that attribute and were more (less) likely to select a TCO product with that attribute. Significant positive coefficients for individuals' contributions to reducing carbon emissions implied that the respondents preferred TCO products through which they could offset more carbon emissions (0.310, $p < 0.01$). The respondents' preferences for lowering carbon emissions were also reflected in the significant positive value of providers' contributions to decarbonisation (0.256, $p < 0.01$). In contrast, the respondents did not prefer TCO products with higher prices (−0.012, $p < 0.01$). The attribute levels of project location, project type, offset product provider and payment time were coded as categorical variables with the levels "Other developing countries," "Waste-to-energy," "Hotel" and "On-site," respectively, as the base (0) level in utility Equation (2). The respondents were more likely to choose a TCO product that was implemented in domestic regions (0.250, $p < 0.01$) or overseas destinations (0.229, $p < 0.01$). The higher preferences for domestic projects over overseas projects underscore the potential of China's voluntary offset market. These preferences align with the reopening of new project registrations within the CCER framework in 2023 and the domestic climate obligations advocated by Carton et al. (2021). The respondents were also most supportive of reforestation and conservation offset projects (0.309, $p < 0.01$) and renewable energy (0.303, $p < 0.01$). The highest value for reforestation-related projects aligns with the conclusions drawn by Choi et al. (2018), MacKerron et al. (2009), Ritchie et al. (2021), and Rotaris et al. (2020). These previous studies also found that nature-based projects were preferred by tourists to human benefit-oriented projects or technology-based projects, suggesting a consistent preference for such initiatives across different investigations. Tourists' preferences for nature-based offset projects may be driven by their strong environmental concerns, the tangible impact these projects offer, the focus of the projects on environmental conservation, tourists' emotional connection with nature, the projects' long-term sustainability and the educational and awareness-raising opportunities these projects offer. The respondents preferred the situation in which they paid for TCO products before departure (0.122, $p < 0.01$) to the base-level situation in which they paid during their trip. This purchasing pattern could potentially be influenced by the booking practices commonly associated with the online travel agencies (OTA). Interestingly, the respondents were less likely to select TCO products provided by airlines (−0.145, $p < 0.01$), which may be related to the fact that airlines are major emitters of greenhouse gases (Graver et al., 2020). This suggests that the public may perceive airlines' involvement in offsetting carbon emissions as "greenwashing" because airlines appear to emphasise their public image over substantial carbon reductions (Hyams & Fawcett, 2013; Watt, 2021). The choice model results showed that offset- and travel-related attributes influenced tourists' choice of TCO, supporting Hypotheses 1. In addition, the standard errors related to carbon offset contributions, domestic or overseas projects, offset product providers, contribution from providers, payment time and price were all significant ($p < 0.01$), indicating that the respondents had heterogeneous preferences for these attributes and their levels.

LVM Results and offsetter profiles

As shown in Table 5, there was a negative relationship between green trust and the opt-out option (−2.006, $p < 0.01$): as green trust increased, the respondents were less likely to choose the "would not offset my carbon emissions" option. That is, increasing green trust led to an increased probability of selecting TCO options. Hence, Hypothesis 2 was supported. This finding is consistent with the findings of Chen et al. (2019), indicating that green trust was positively related to the intention to engage in green practices and positive word of mouth. Table 6 presents the results from the measurement equations in the LVM, where green trust in carbon offsets was found to

Table 5. Estimates of the TCO choice model.

Variable	Coeff.	SE	SD	SE
Attribute				
Carbon offset contribution (tonnes)	0.310***	0.059	0.995***	0.068
Project location				
Other developing country	Base level			
Domestic	0.250***	0.0774	−0.642***	0.084
Overseas destination	0.229***	0.077	−0.258***	0.120
Project type				
Waste-to-energy	Base level			
Reforestation and conservation	0.309***	0.090	0.166	0.103
Renewable energy	0.303***	0.096	0.194	0.160
Community project	0.040	0.095	0.228	0.141
Offset product provider				
Hotel	Base level			
Airline	−0.145***	0.063	−0.273***	0.137
Online travel agency	−0.097	0.062	0.189**	0.114
Carbon offset company	−0.114	0.102	0.11190	0.211
Contribution from product provider (tonnes)	0.256***	0.047	0.358***	0.053
Payment time				
On-site	Base level			
Before departure	0.122***	0.048	0.304***	0.091
After travel	0.089	0.075	−0.313***	0.089
Price (¥)	−0.012***	0.002	−0.028***	0.001
Alternative specific constant (opt-out)	−2.796***	0.300		
Latent variable				
Green trust	−2.006***	0.147		

Note. ***, and ** indicate significance at the 1%, and 5% levels, respectively. SD = standard deviation; SE = standard error.

Table 6. Estimates of the measurement equations of the latent variable model.

Latent variable: Green trust	Mean	Coeff.	SE
The environmental reputation of this carbon offset product is generally reliable	5.79	1.953***	0.143
The environmental performance of carbon offset products is generally dependable	5.88	1.760***	0.129
The environmental claims made by carbon offset products are generally trustworthy	5.89	1.902***	0.140
The environmental concerns of carbon offset products meet my pro-environmental expectations	5.97	1.511***	0.114
The carbon offset product upholds its promise of environmental protection	5.81	1.833***	0.132

Note. *** Indicates significance at the 1% level. SE = standard error.

be positively correlated with perceptions of TCO products' reliability, dependability, trustworthiness, environmental concerns and promise of environmental protection ($p < 0.01$).

The structural equations in the LVM (see Table 7) showed that gender, income level, marital status, employment status and offset experience had statistically significant effects on the respondents' trust in TCO products. Women were more likely than men to trust TCO products (0.271, $p < 0.01$), which is in line with the findings of Westin et al. (2020) from a Swedish sample. The respondents with carbon offset experience were also more likely to trust TCO products than were those without offset experience (0.917, $p < 0.01$).

The low-income respondents (–0.228, $p < 0.01$), the unemployed respondents (–0.901, $p < 0.01$), and the single respondents (–0.588, $p < 0.01$) were less likely than other respondents to trust carbon offset products. As these socio-demographic characteristics and past experiences affected TCO choices *via* the latent variable, Hypotheses 3 and 4 were supported. These findings are in line with previous studies indicating that women and individuals with higher income levels are associated with more pro-environmental behaviours (Dolnicar, 2004, 2010; Schwirplies et al., 2019) than are single and unemployed people (Oliveira & Dias, 2019).

Table 7. Estimates of the structural component of the latent variable model.

	Green trust	
Variable	Coeff.	SE
Gender (Male = 0)		
Gender (Female)	0.271***	0.067
Age (40–59 = 0)		
Age (18–39 years)	0.012	0.074
Age (≥ 60 years)	0.205	0.149
Educational attainment (lower than bachelor's degree = 0)		
Education (high)	0.132	0.115
Income (¥144,001–420,000 = 0)		
Income (< ¥144,001)	−0.228***	0.083
Income (> ¥420,000)	−0.014	0.089
Marital status (not single = 0)		
Single	−0.588***	0.110
Occupation (not employed = 0)		
Unemployed	−0.901***	0.313
Carbon offset experience (no = 0)		
Yes	0.917***	0.078

Note. *** Indicates significance at the 1% level. SE: standard error.

Economic value of TCO

Table 8 shows the estimation results for WTP (i.e. marginal rates of price substitution, see Equation (9)) from the mean values of the attribute parameters in the choice model and their 95% confidence intervals. As expected, compared with offsetting carbon emissions, "no TCO" was less preferred by the respondents. On average, the respondents were willing to pay ¥26.86 (≈ US$3.95) per tonne of carbon emissions offset ($p < 0.01$). This was lower than the WTP reported for Australian (US$19.27; Choi & Ritchie, 2014), Italian (US$13.43–42.52; Rotaris et al., 2020), and German (US$44.78; Schwirplies et al., 2019) samples. The observed lower WTP per tonne of carbon offset in the Chinese sample compared with the samples from other countries suggests potential variations in WTP across countries, influenced by factors such as income disparities (World Bank, 2023) and varying levels of environmental awareness (Babakhani et al., 2017; Carlsson et al., 2021). In addition, the respondents were willing to pay an average of ¥22.13 per additional tonne of carbon emissions offset by the provider ($p < 0.01$). The respondents were willing to pay an average of ¥21.65 for a domestic project ($p < 0.05$), ¥1.82 higher than their WTP for a project at their destination ($p < 0.05$). Compared with the baseline project type (i.e. waste-to-energy), the respondents were willing to pay an average of ¥26.76 for reforestation and conservation projects ($p < 0.01$), which was slightly higher than their WTP for a renewable energy project ($p < 0.05$). Interestingly, the significant negative value of the mean WTP (−12.43, $p < 0.01$) implied that the respondents would be much less willing to pay for TCO products provided by airlines than they would be for TCO products provided by hotels. The respondents preferred to pay before departure, with a mean WTP estimate of ¥10.59 ($p < 0.05$) compared with on-site payments. For an optimal TCO product (assuming 1 tonne of carbon emissions during a trip) with all of the most desirable attributes (e.g. offsetting 1 tonne from the individual, a domestic project, a reforestation and conservation project, offsetting 1 tonne from the provider and a pre-departure payment), the respondents were willing to pay about ¥108 (i.e. 26.86 + 21.65 + 26.76 + 22.13 + 10.59, respectively). These results supported Hypothesis 1. We further compared the WTP estimates and only found significant differences in WTP between project types ($p < 0.01$).

Implications and conclusion

After a 6-year break, the reintroduction of new project registrations within the CCER signals the revival of China's voluntary carbon market (Mao, 2023). This paper is aligned with policy

Table 8. WTP values for non-monetary attributes.

Attribute	WTP (¥)	*SE*	95% CI	
Carbon offset contribution (tonnes)	26.86***	5.74	15.61	38.11
Project location				
Other developing country	Base level			
Domestic	21.65**	8.74	4.52	38.78
Overseas destination	19.83**	8.37	3.42	36.25
Project type				
Waste-to-energy	Base level			
Reforestation and conservation	26.76***	10.24	6.69	46.82
Renewable energy	26.20**	10.64	5.33	47.07
Community project	3.45	8.52	−13.24	20.14
Offset product provider				
Hotel	Base level			
Airline	−12.43**	5.82	−23.84	−1.03
Online travel agency	−8.39	5.47	−19.13	2.34
Carbon offset company	−9.87	10.81	−31.06	11.32
Contribution from product provider (tonnes)	22.13***	4.01	14.27	29.99
Payment time				
On-site	Base level			
Before departure	10.59**	4.45	1.86	19.31
After travel	7.72	6.29	−4.61	20.06

Note. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively. CI = confidence interval; SE: standard error; WTP: willingness to pay.

indications and ambitions for industry-wide offsetting, as it investigates the feasibility of an innovative voluntary offset product designed for individual tourists, encompassing the entirety of their journey and the entire tourism industry. It is worth noting that carbon offsets should be adopted and developed cautiously to avoid "moral disengagement" from the harm of the carbon footprint (Fankhauser et al., 2022). The underlying idea behind TCO and other travel offset products should be "avoiding the unavoidable" (Lovell et al., 2009). When regarding tourism decarbonisation as a system, the "avoiding the unavoidable" principle uses an "energy hierarchy" as a decision-making and planning tool—reduce, renew/replace, then offset—offering guidance on reducing energy use and using renewables before resorting to offsetting. This principle suggests that the tourism industry should reduce travel emissions before offsetting and that all other narratives concerning travel carbon offsetting should be considered part of the decarbonisation system. The industry should also target knowledgeable and responsible consumers who incorporate offsets into a broader strategy of carbon reduction practices, emphasising self-control and governance of individual consumption.

Using the HCM, this study employed the determinants of TCO choices. The findings indicate the following: (1) the respondents preferred to opt-in when they were provided with a TCO product and were willing to pay ¥108 (about $15.88) for an optimal TCO product for a trip with a 1-tonne carbon footprint; (2) offset-related attributes (offset quantity, offset location, and project type) and travel-related attributes (product provider, contributions from the provider, and payment time) influenced the choice of a TCO product; and (3) the respondents' levels of green trust influenced their preferences concerning TCO products.

Interestingly, although we found a negative preference for airlines as offset providers, the majority of research in the tourism domain has predominantly centred on carbon offsets provided by airlines. Few studies have identified a negative inclination towards flying carbon offsets among specific traveller groups. Ritchie et al. (2021) found that frequent flyer members and business travellers were unlikely to engage in carbon offsetting, reflecting a dilemma for cosmopolitan travellers highlighted by Gössling (2002). Some recent contributions to tourism scholarship have recognised and addressed gaps between existing offsetting products and consumer preferences (Babakhani et al., 2017; Denton et al., 2020; Guix et al., 2022; Segerstedt & Grote, 2016; Zhang et al., 2019). Babakhani et al. (2017) highlighted that consumers' limited awareness of carbon offsetting diminishes its appeal. Guix et al. (2022) indicated that misleading messages hinder accurate communication of products' pro-environmental characteristics and found that airlines tend to deliver misleading communications concerning carbon offsetting. However, these studies on carbon offsets all focused on aviation. We expect that the findings of this paper will encourage tourism academics to rethink and reflect on their research directions and to broaden their perspectives on carbon offsets, moving beyond the conventional focus on aviation.

In summary, the theoretical contributions of this study are significant and warrant careful consideration. First, this study contributes to the literature on tourism and carbon offsets, which has thus far predominantly focused on flight-related offsets, sidelining other forms of offsetting. This study proposes the creation of innovative, industry-wide TCO products to offset emissions throughout individual tourists' travel processes. In addition, the discovery of the negative WTP for airlines as TCO product providers should prompt an exploration of this aversion and should open new avenues for future research in the field of carbon offsets within the tourism industry. Second, we enhance the comprehension of tourists' offsetting decision-making processes by examining the influences of offset-related attributes (including offset quantity, offset location and project type) and travel-related attributes (including product provider, contributions from the provider, and payment time) in conjunction with levels of green trust and social-demographic characteristics on TCO selection. The intricacy of offsetting choice behaviours was elucidated by considering the interplay of external determinants (TCO attributes) and internal factors, including psychological factors (green trust) and social demographics (Wang et al., 2021) within the HCM framework. In addition, the positive effect of green trust on individuals' choice of TCO products adds to the body of research focused on the factors hindering (or facilitating) consumers' choice of carbon offset products (Babakhani et al., 2017; Denton et al., 2020; Guix et al., 2022; Segerstedt & Grote, 2016; Zhang et al., 2019). Third, this study extends the literature by both estimating tourists' WTP for offsetting carbon emissions across their entire travel journey and providing economic values for each attribute or level. This contribution aims to initiate a broader discussion. For instance, the lower observed WTP per tonne of carbon offset in the Chinese sample compared with the WTP values in samples from other countries indicates that future research should delve into cross-country differences in WTP per tonne of carbon offset and explore the underlying causes of these differences. Finally, this study provides evidence supporting the application of the HCM in tourism, as this methodology facilitates the amalgamation of TCO attributes, tourists' socio-economic characteristics and latent variables such as green trust using MMNL–LVM in an HCM framework. These analyses and findings encourage the integration and refinement of discrete choice modelling techniques into research on psychological inclinations and consumer behaviour within the field of tourism.

The practical implications of the research findings are substantial and are highly relevant for various stakeholders in the tourism field. First, the respondents' preferences for TCO products signal the need for tourism providers to offer TCO options that provide access to travel carbon emissions data and the corresponding offsetting information and channels. Second, the results regarding the importance of TCO product attributes provide tourism and offset practitioners with references to aid in the development of a more attractive TCO product. This product should contribute to reducing carbon emissions from both demand and supply sides by focusing on domestic projects, renewable energy investments, non-airline providers, and pre-departure payment options. Given the historically tepid adoption of carbon offset practices in tourism, businesses should merge carbon offsets and tourism-related attributes while exploring novel operating models. Lessons from real-world practices in tourism agencies, such as agency, merchant, and advertising business models, could be adapted to develop effective TCO products or services. It is worth noting that credibility is essential for businesses developing carbon offset products. It is crucial for businesses to ensure real and additional emissions reductions, avoid greenwashing and comply with regulations. Credible offsets enhance environmental responsibility, reputation and long-term viability, demonstrating a commitment to sustainability and ethical practices while mitigating risks and gaining market acceptance. Third, the positive links between green trust in carbon offsets and individuals' choices of TCO products and the negative preference for airlines as providers may prompt governments and offset practitioners to correct their potentially deceptive green image and build public trust in their carbon offsetting practices. The positive influence of green trust on consumers' intention to engage in a behaviour is consistent with the findings of Sung et al. (2021). Reliable, transparent communication channels and products should be built and delivered to consumers. Finally, considering that the mean WTP for net offset per tonne of CO_2 (¥26.86≈US$3.95) was lower than the current carbon price in China's carbon market (¥48≈US$7.06), Chinese practitioners of TCO should aim to strike a balance between benefits and costs while catering to market preferences, such as by integrating reforestation and conservation projects into the TCO framework to enhance offsetters' WTP. Beyond participants' WTP, however, carbon offset pricing also depends on the carbon market and regional regulations.

This study also has limitations that provide avenues for future research. First, while the HCM proves powerful, its computational demands and data-intensive nature pose challenges. In this study, we parsimoniously introduced a latent variable in the utility function. Further research could introduce latent variables in each continuous and categorical attribute level and explore different approaches to introducing more latent variables in an HCM. Furthermore, although the HCM outperformed other choice models in this study, future studies of tourism consumer behaviour could compare the costs and benefits of different modelling techniques. In addition, the study did not thoroughly address potential modelling issues that may violate behavioural assumptions, such as scale heterogeneity and attribute non-attendance. Addressing these concerns and optimising the experimental design to accommodate these factors is a promising future research avenue. Second, while this study identified the positive influence of green trust on offset preferences, further investigation could delve into how green trust influences offset preferences and how to build consumers' trust in the offset market. Furthermore, a significant disparity exists between attitudes and behaviours regarding TCO purchases. This gap can be attributed to social norms; a lack of motivation, knowledge or information; free rider concerns and the perceived lack of credibility of offset initiatives (Denton et al., 2020; Higham et al., 2019). In addition to trust issues, future research should explore other barriers to and facilitators of individual engagement in travel carbon offsetting. Third, the study's sample size was limited and may not fully represent the broader population of potential Chinese outbound tourists. Potential sampling bias may have arisen due to the overrepresentation of highly educated and high-income individuals. This overrepresentation may have occurred because the respondents retained in the analysis were those who had travelled abroad for leisure purposes in the last 5 years, would like to travel overseas in the coming year and could understand carbon offsetting after it was described to them. Fourth, the potential of the stated preference survey data in predicting the potential impacts of new TCO products is accompanied by hypothetical bias arising from stated and actual choices in real-world situations. Future TCO studies should collaborate with tourism businesses to acquire real-world data for analysis. Finally, this study only explored the possibility of a hypothetical TCO product and its determinants. Further study is needed to determine how to operate such products in the tourism industry. Overall, this study advocates for a systematic approach to tourism decarbonisation, emphasising that tourists should prioritise reducing travel emissions before considering offsetting, treating offsetting as the final step to "avoid the unavoidable." Such an approach necessitates collaborative efforts from various stakeholders within the industry. Future research and policy endeavours should focus on fostering multi-stakeholder cooperation to amplify the impact of individual initiatives across the tourism sector (Higham et al., 2019). In addition, the successful development of voluntary offsetting behaviour among tourists highlights the need for studies on challenges such as the lack of motivation to purchase carbon offsets and the free rider issues, ensuring project credibility and regulations and implementing effective communication strategies (Fankhauser et al., 2022).

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References

Albaladejo, I. P., & Díaz-Delfa, M. T. (2021). The effects of motivations to go to the country on rural accommodation choice: A hybrid discrete choice model. *Tourism Economics*, *27*(7), 1484–1507. https://doi.org/10.1177/1354816620912062
Atasoy, B., Glerum, A., & Bierlaire, M. (2013). Attitudes towards mode choice in Switzerland. *disP - the Planning Review*, *49*(2), 101–117. https://doi.org/10.1080/02513625.2013.827518
Babakhani, N., Ritchie, B. W., & Dolnicar, S. (2017). Improving carbon offsetting appeals in online airplane ticket purchasing: Testing new messages, and using new test methods. *Journal of Sustainable Tourism*, *25*(7), 955–969. https://doi.org/10.1080/09669582.2016.1257013
Badgley, G., Freeman, J., Hamman, J. J., Haya, B., Trugman, A. T., Anderegg, W. R. L., & Cullenward, D. (2022). Systematic over-crediting in California's forest carbon offsets program. *Global Change Biology*, *28*(4), 1433–1445. https://doi.org/10.1111/gcb.15943
Becken, S., & Mackey, B. (2017). What role for offsetting aviation greenhouse gas emissions in a deep-cut carbon world? *Journal of Air Transport Management*, *63*, 71–83. https://doi.org/10.1016/j.jairtraman.2017.05.009
Ben-Akiva, M., Mcfadden, D., Train, K., Walker, J., Bhat, C., Bierlaire, M., Bolduc, D., Boersch-Supan, A., Brownstone, D., Bunch, D. S., Daly, A., De Palma, A., Gopinath, D., Karlstrom, A., & Munizaga, M. A. (2002). Hybrid choice models: Progress and challenges. *Marketing Letters*, *13*(3), 163–175. https://doi.org/10.1023/A:1020254301302
Blasch, J., & Farsi, M. (2014). Context effects and heterogeneity in voluntary carbon offsetting – a choice experiment in Switzerland. *Journal of Environmental Economics and Policy*, *3*(1), 1–24. http://doi.org/10.1080/21606544.2013.842938
Boneau, C. A. (1974). Paradigm regained? Cognitive behaviorism restated. *American Psychologist*, *29*(5), 297–309. https://doi.org/10.1037/h0037620
Brouwer, R., Brander, L., & Van Beukering, P. (2008). "A convenient truth": Air travel passengers' willingness to pay to offset their CO_2 emissions. *Climatic Change*, *90*(3), 299–313. https://doi.org/10.1007/s10584-008-9414-0
Burt, R. S., & Knez, M. (1995). Kinds of third-party effects on trust. *Rationality and Society*, *7*(3), 255–292. https://doi.org/10.1177/1043463195007003003
Carlsson, F., Kataria, M., Krupnick, A., Lampi, E., Löfgren, Å., Qin, P., Sterner, T., & Yang, X. (2021). The climate decade: Changing attitudes on three continents. *Journal of Environmental Economics and Management*, *107*, 102426. https://doi.org/10.1016/j.jeem.2021.102426
Carton, W., Lund, J. F., & Dooley, K. (2021). Undoing equivalence: Rethinking carbon accounting for just carbon removal. *Frontiers in Climate*, *3*, 664130. https://doi.org/10.3389/fclim.2021.664130
Chapman, E. (2020). Four types of carbon offset projects. *EIC*. https://www.eic.co.uk/4-types-of-carbon-offset-projects/
Charness, G., & Rabin, M. (2002). Understanding social preferences with simple tests. *The Quarterly Journal of Economics*, *117*(3), 817–869. https://doi.org/10.1162/003355302760193904
Chen, H., Bernard, S., & Rahman, I. (2019). Greenwashing in hotels: A structural model of trust and behavioral intentions. *Journal of Cleaner Production*, *206*, 326–335. https://doi.org/10.1016/j.jclepro.2018.09.168
Chen, Y., & Chang, C. (2012). Enhance green purchase intentions: The roles of green perceived value, green perceived risk, and green trust. *Management Decision*, *50*(3), 502–520. https://doi.org/10.1108/00251741211216250

Chen, Y.-S. (2010). The drivers of green brand equity: Green brand image, green satisfaction, and green trust. *Journal of Business Ethics*, *93*(2), 307–319. https://doi.org/10.1007/s10551-009-0223-9

Choi, A. S. (2020). The impact of arbitrary constraints over the payment parameter on WTP: A case of a normally distributed random parameter. *Journal of Environmental Economics and Policy*, *9*(2), 125–139. https://doi.org/10.1080/21606544.2019.1614482

Choi, A. S., Gössling, S., & Ritchie, B. W. (2018). Flying with climate liability? Economic valuation of voluntary carbon offsets using forced choices. *Transportation Research Part D: Transport and Environment*, *62*, 225–235. https://doi.org/10.1016/j.trd.2018.02.018

Choi, A. S., & Ritchie, B. W. (2014). Willingness to pay for flying carbon neutral in Australia: An exploratory study of offsetter profiles. *Journal of Sustainable Tourism*, *22*(8), 1236–1256. https://doi.org/10.1080/09669582.2014.894518

Chuah, S. H.-W., El-Manstrly, D., Tseng, M.-L., & Ramayah, T. (2020). Sustaining customer engagement behavior through corporate social responsibility: The roles of environmental concern and green trust. *Journal of Cleaner Production*, *262*, 121348. https://doi.org/10.1016/j.jclepro.2020.121348

Costa Pinto, D., Herter, M. M., Rossi, P., & Borges, A. (2014). Going green for self or for others? Gender and identity salience effects on sustainable consumption. *International Journal of Consumer Studies*, *38*(5), 540–549. https://doi.org/10.1111/ijcs.12114

Daly, A., Hess, S., Patruni, B., Potoglou, D., & Rohr, C. (2012). Using ordered attitudinal indicators in a latent variable choice model: A study of the impact of security on rail travel behaviour. *Transportation*, *39*(2), 267–297. https://doi.org/10.1007/s11116-011-9351-z

Denton, G., Chi, O. H., & Gursoy, D. (2020). An examination of the gap between carbon offsetting attitudes and behaviors: Role of knowledge, credibility and trust. *International Journal of Hospitality Management*, *90*, 102608. https://doi.org/10.1016/j.ijhm.2020.102608

Dhanda, K. K. (2014). The role of carbon offsets in achieving carbon neutrality: An exploratory study of hotels and resorts. *International Journal of Contemporary Hospitality Management*, *26*(8), 1179–1199. https://doi.org/10.1108/IJCHM-03-2013-0115

Dolnicar, S. (2004). Insights into sustainable tourists in Austria: A data-based a priori segmentation approach. *Journal of Sustainable Tourism*, *12*(3), 209–218. https://doi.org/10.1080/09669580408667234

Dolnicar, S. (2010). Identifying tourists with smaller environmental footprints. *Journal of Sustainable Tourism*, *18*(6), 717–734. https://doi.org/10.1080/09669581003668516

Eijgelaar, E. (2011). Voluntary carbon offsets a solution for reducing tourism emissions? Assessment of communication aspects and mitigation potential. *European Journal of Transport and Infrastructure Research*, *11*(3), 281–296. https://doi.org/10.18757/EJTIR.2011.11.3.2933

Ember. (2022). European Union Emission Trading System (EU-ETS) carbon pricing in 2022 (in euros per metric ton). *Statista*. Accessed 22 March 2023. https://www.statista.com/statistics/1322214/carbon-prices-european-union-emission-trading-scheme/

Fankhauser, S., Smith, S. M., Allen, M., Axelsson, K., Hale, T., Hepburn, C., Kendall, J. M., Khosla, R., Lezaun, J., Mitchell-Larson, E., Obersteiner, M., Rajamani, L., Rickaby, R., Seddon, N., & Wetzer, T. (2022). The meaning of net zero and how to get it right. *Nature Climate Change*, *12*(1), 15–21. https://doi.org/10.1038/s41558-021-01245-w

Ganesan, S. (1994). Determinants of long-term orientation in buyer-seller relationships. *Journal of Marketing*, *58*(2), 1–19. https://doi.org/10.2307/1252265

Gössling, S. (2002). Human–environmental relations with tourism. *Annals of Tourism Research*, *29*(2), 539–556. http://doi.org/10.1016/S0160-7383(01)00069-X

Gössling, S., Broderick, J., Upham, P., Ceron, J.-P., Dubois, G., Peeters, P., & Strasdas, W. (2007). Voluntary carbon offsetting schemes for aviation: Efficiency, credibility and sustainable tourism. *Journal of Sustainable Tourism*, *15*(3), 223–248. https://doi.org/10.2167/jost758.0

Gössling, S., Haglund, L., Kallgren, H., Revahl, M., & Hultman, J. (2009). Swedish air travellers and voluntary carbon offsets: Towards the co-creation of environmental value? *Current Issues in Tourism*, *12*(1), 1–19. https://doi.org/10.1080/13683500802220687

Graver, B., Rutherford, D., & Zheng, S. (2020). CO_2 emissions from commercial aviation: 2013, 2018, and 2019. *The International Council on Clean Transportation*. https://policycommons.net/artifacts/3803497/co2-emissions-from-commercial-aviation/4609325/

Guix, M., Ollé, C., & Font, X. (2022). Trustworthy or misleading communication of voluntary carbon offsets in the aviation industry. *Tourism Management*, *88*, 104430. https://doi.org/10.1016/j.tourman.2021.104430

Hamrick, K., & Gallant, M. (2018). Voluntary carbon markets insights: 2018 outlook and first-quarter trends. *Ecosystem Marketplace*. https://www.forest-trends.org/wp-content/uploads/2018/09/VCM-Q1-Report_Full-Version-2.pdf

Hao, F., Qiu, R. T. R., Park, J., & Chon, K. (2022). The myth of contactless hospitality service: Customers' willingness to pay. *Journal of Hospitality & Tourism Research*, *47*(8), 1478–1502. https://doi.org/10.1177/10963480221081781

Hess, S., & Daly, A. (2014). *Handbook of choice modelling*. Edward Elgar Publishing. https://doi.org/10.4337/9781781003152

Hess, S., & Palma, D. (2019). *Apollo*: A flexible, powerful and customisable freeware package for choice model estimation and application. *Journal of Choice Modelling*, *32*, 100170. https://doi.org/10.1016/j.jocm.2019.100170

Higham, J., Ellis, E., & Maclaurin, J. (2019). Tourist aviation emissions: A problem of collective action. *Journal of Travel Research*, *58*(4), 535–548. https://doi.org/10.1177/0047287518769764

Hyams, K., & Fawcett, T. (2013). The ethics of carbon offsetting. *WIREs Climate Change*, *4*(2), 91–98. https://doi.org/10.1002/wcc.207

International Air Transport Association (IATA). (2022). Aviation carbon offsetting. *IATA*. https://www.iata.org/contentassets/922ebc4cbcd24c4d9fd55933e7070947/aviation_carbon_offsetting_guidelines.pdf

Juvan, E., & Dolnicar, S. (2017). Drivers of pro-environmental tourist behaviours are not universal. *Journal of Cleaner Production*, *166*, 879–890. https://doi.org/10.1016/j.jclepro.2017.08.087

Kalafatis, S. P., Pollard, M., East, R., & Tsogas, M. H. (1999). Green marketing and Ajzen's theory of planned behaviour: A cross-market examination. *Journal of Consumer Marketing*, *16*(5), 441–460. https://doi.org/10.1108/07363769910289550

Kim, J. H., Bae, Y. K., & Chung, J.-H. (2012). Effects of personal proenvironmental attitudes on mode choice behavior: New ecofriendly water transit system in Seoul, South Korea. *Transportation Research Record: Journal of the Transportation Research Board*, *2274*(1), 175–183. https://doi.org/10.3141/2274-19

Lancaster, K. J. (1966). A new approach to consumer theory. *Journal of Political Economy*, *74*(2), 132–157. https://doi.org/10.1086/259131

Lee, C., & Mjelde, J. W. (2007). Valuation of ecotourism resources using a contingent valuation method: The case of the Korean DMZ. *Ecological Economics*, *63*(2-3), 511–520. https://doi.org/10.1016/j.ecolecon.2006.12.011

Lim, H.-J., & Yoo, S.-H. (2014). Train travel passengers' willingness to pay to offset their CO_2 emissions in Korea. *Renewable and Sustainable Energy Reviews*, *32*, 526–531. https://doi.org/10.1016/j.rser.2014.01.010

Lindberg, K., Veisten, K., & Halse, A. H. (2019). Analysing the deeper motivations for nature-based tourism facility demand: A hybrid choice model of preferences for a reindeer visitor center. *Scandinavian Journal of Hospitality and Tourism*, *19*(2), 157–174. https://doi.org/10.1080/15022250.2018.1482565

Lovell, H., Bulkeley, H., & Liverman, D. (2009). Carbon offsetting: Sustaining consumption? *Environment and Planning A: Economy and Space*, *41*(10), 2357–2379. https://doi.org/10.1068/a40345

Lu, J.-L., & Shon, Z. Y. (2012). Exploring airline passengers' willingness to pay for carbon offsets. *Transportation Research Part D: Transport and Environment*, *17*(2), 124–128. https://doi.org/10.1016/j.trd.2011.10.002

MacKerron, G. J., Egerton, C., Gaskell, C., Parpia, A., & Mourato, S. (2009). Willingness to pay for carbon offset certification and co-benefits among (high-)flying young adults in the UK. *Energy Policy*, *37*(4), 1372–1381. http://doi.org/10.1016/j.enpol.2008.11.023

Mao, Z. (2023). China's voluntary carbon market set to relaunch as registration begins. *Asia House*. https://asiahouse.org/research_posts/chinas-voluntary-carbon-market-set-to-relaunch-as-registration-begins/

Masiero, L., Heo, C. Y., & Pan, B. (2015). Determining guests' willingness to pay for hotel room attributes with a discrete choice model. *International Journal of Hospitality Management*, *49*, 117–124. https://doi.org/10.1016/j.ijhm.2015.06.001

Masiero, L., & Hrankai, R. (2022). Modeling tourist accessibility to peripheral attractions. *Annals of Tourism Research*, *92*, 103343. https://doi.org/10.1016/j.annals.2021.103343

Masiero, L., & Qiu, R. T. R. (2018). Modeling reference experience in destination choice. *Annals of Tourism Research*, *72*, 58–74. https://doi.org/10.1016/j.annals.2018.06.004

McFadden, D. (1974). Conditional logit analysis of qualitative choice behavior. In P. Zarembka (Ed.), *Frontiers in econometrics* (pp. 105–142). Academic Press.

McNish, T. (2012). Carbon offsets are a bridge too far in the tradable property rights revolution. *The Harvard Environmental Law Review*, *36*(2), 387–443.

Morley, C. L. (1992). A microeconomic theory of international tourism demand. *Annals of Tourism Research*, *19*(2), 250–267. https://doi.org/10.1016/0160-7383(92)90080-9

Oliveira, G. D., & Dias, L. C. (2019). Influence of demographics on consumer preferences for alternative fuel vehicles: A review of choice modelling studies and a study in Portugal. *Energies*, *12*(2), 318. https://doi.org/10.3390/en12020318

Ouvrard, B., Abildtrup, J., & Stenger, A. (2020). Nudging acceptability for wood ash recycling in forests: A choice experiment. *Ecological Economics*, *177*, 106748. https://doi.org/10.1016/j.ecolecon.2020.106748

Prato, C. G., Bekhor, S., & Pronello, C. (2012). Latent variables and route choice behavior. *Transportation*, *39*(2), 299–319. https://doi.org/10.1007/s11116-011-9344-y

Pröbstl-Haider, U., & Haider, W. (2014). The role of protected areas in destination choice in the European Alps. *Zeitschrift für Wirtschaftsgeographie*, *58*(1), 144–163. https://doi.org/10.1515/zfw.2014.0010

Raffaelli, R., Franch, M., Menapace, L., & Cerroni, S. (2022). Are tourists willing to pay for decarbonising tourism? Two applications of indirect questioning in discrete choice experiments. *Journal of Environmental Planning and Management*, *65*(7), 1240–1260. https://doi.org/10.1080/09640568.2021.1918651

Ranaweera, C., & Prabhu, J. (2003). The influence of satisfaction, trust and switching barriers on customer retention in a continuous purchasing setting. *International Journal of Service Industry Management*, *14*(4), 374–395. https://doi.org/10.1108/09564230310489231

Ritchie, B. W., Kemperman, A., & Dolnicar, S. (2021). Which types of product attributes lead to aviation voluntary carbon offsetting among air passengers? *Tourism Management*, *85*, 104276. https://doi.org/10.1016/j.tourman.2020.104276

Rotaris, L., Giansoldati, M., & Scorrano, M. (2020). Are air travellers willing to pay for reducing or offsetting carbon emissions? Evidence from Italy. *Transportation Research Part A: Policy and Practice*, *142*, 71–84. https://doi.org/10.1016/j.tra.2020.10.014

Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. (1998). Introduction to special topic forum: Not so different after all: A cross-discipline view of trust. *Academy of Management Review*, *23*(3), 393–404. https://doi.org/10.5465/amr.1998.926617

Schaafsma, M., & Brouwer, R. (2020). Substitution effects in spatial discrete choice experiments. *Environmental and Resource Economics*, *75*(2), 323–349. https://doi.org/10.1007/s10640-019-00368-1

Schurr, P. H., & Ozanne, J. L. (1985). Influences on exchange processes: Buyers' preconceptions of a seller's trustworthiness and bargaining toughness. *Journal of Consumer Research*, *11*(4), 939–953. https://doi.org/10.1086/209028

Schwirplies, C., Dütschke, E., Schleich, J., & Ziegler, A. (2019). The willingness to offset CO_2 emissions from traveling: Findings from discrete choice experiments with different framings. *Ecological Economics*, *165*, 106384. https://doi.org/10.1016/j.ecolecon.2019.106384

Seekamp, E., Jurjonas, M., & Bitsura-Meszaros, K. (2019). Influences on coastal tourism demand and substitution behaviors from climate change impacts and hazard recovery responses. *Journal of Sustainable Tourism*, *27*(5), 629–648. https://doi.org/10.1080/09669582.2019.1599005

Segerstedt, A., & Grote, U. (2016). Increasing adoption of voluntary carbon offsets among tourists. *Journal of Sustainable Tourism*, *24*(11), 1541–1554. https://doi.org/10.1080/09669582.2015.1125357

Simmel, G., & Wolff, K. H. (1950). *The sociology of Georg Simmel*. Free Press. http://archive.org/details/sociologyofgeorg030082mbp

Slater, H., de Boer, D., Guoqiang, Q., & Shu, W. (2019). *2019 China carbon pricing survey*. China Carbon Forum.

Smith, I. J., & Rodger, C. J. (2009). Carbon emission offsets for aviation-generated emissions due to international travel to and from New Zealand. *Energy Policy*, *37*(9), 3438–3447. https://doi.org/10.1016/j.enpol.2008.10.046

Sriarkarin, S., & Lee, C.-H. (2018). Integrating multiple attributes for sustainable development in a national park. *Tourism Management Perspectives*, *28*, 113–125. https://doi.org/10.1016/j.tmp.2018.08.007

State Council of People's Republic of China. (2022). *The cumulative trading volume of the national carbon market*. http://www.gov.cn/xinwen/2022-07/17/content_5701404.htm

Straughan, R. D., & Roberts, J. A. (1999). Environmental segmentation alternatives: A look at green consumer behavior in the new millennium. *Journal of Consumer Marketing*, *16*(6), 558–575. https://doi.org/10.1108/07363769910297506

Sung, P. L., Hsiao, T. Y., Huang, L., & Morrison, A. M. (2021). The influence of green trust on travel agency intentions to promote low-carbon tours for the purpose of sustainable development. *Corporate Social Responsibility and Environmental Management*, *28*(4), 1185–1199. https://doi.org/10.1002/csr.2131

Tellis, G. J., Yin, E., & Bell, S. (2009). Global consumer innovativeness: Cross-country differences and demographic commonalities. *Journal of International Marketing*, *17*(2), 1–22. https://doi.org/10.1509/jimk.17.2.1

Temme, D., Paulssen, M., & Dannewald, T. (2008). Incorporating latent variables into discrete choice models: A simultaneous estimation approach using SEM software. *Business Research*, *1*(2), 220–237. https://doi.org/10.1007/BF03343535

The Voluntary Carbon Market Dashboard. (2023). *Climate focus*. https://climatefocus.com/initiatives/voluntary-carbon-market-dashboard/

Thomas, M. (2022, July 6). Environmentalists sue Dutch airline KLM for 'greenwashing'. *BBC News*. https://www.bbc.com/news/science-environment-61556984

Ulrike, P.-H., Wolfgang, H., Veronika, W., & Ben, B. (2015). Will climate change increase the attractiveness of summer destinations in the European Alps? A survey of German tourists. *Journal of Outdoor Recreation and Tourism*, *11*, 44–57.

Wang, T., Shen, B., Springer, C. H., & Hou, J. (2021). What prevents us from taking low-carbon actions? A comprehensive review of influencing factors affecting low-carbon behaviors. *Energy Research & Social Science*, *71*, 101844. https://doi.org/10.1016/j.erss.2020.101844

Watt, R. (2021). The fantasy of carbon offsetting. *Environmental Politics*, *30*(7), 1069–1088. https://doi.org/10.1080/09644016.2021.1877063

Westin, K., Nordlund, A., Jansson, J., & Nilsson, J. (2020). Goal framing as a tool for changing people's car travel behavior in Sweden. *Sustainability*, *12*(9), 3695. https://doi.org/10.3390/su12093695

Wissner, N., Schneider, L., Jung, H., Hernández Orozco, E., Kwamboka, E., Johnson, F., & Bößner, S. (2022). Sustainable development impacts of selected project types in the voluntary carbon market. *Öko-Institut*. https://allianz-entwicklung-klima.de/wp-content/uploads/2022/05/Oeko-Institut_2022_Sustainable-development-impacts-of-selected-projects-types-VCM.pdf

World Bank. (2023). *GDP per capita (current US$)*. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

Xie, Y., Danaf, M., Lima Azevedo, C., Akkinepally, A. P., Atasoy, B., Jeong, K., Seshadri, R., & Ben-Akiva, M. (2019). Behavioral modeling of on-demand mobility services: General framework and application to sustainable travel incentives. *Transportation*, *46*(6), 2017–2039. https://doi.org/10.1007/s11116-019-10011-z

Zhang, B., Ritchie, B., Mair, J., & Driml, S. (2019). Is the airline trustworthy? The impact of source credibility on voluntary carbon offsetting. *Journal of Travel Research*, *58*(5), 715–731. https://doi.org/10.1177/0047287518775781