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Article

Examining Air Travellers' Willingness to Pay for Non-voluntary Environment-related Fees: The Case of SAF Surcharge and Carbon Taxes

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Abstract This study aims to investigate air travellers' Willingness to Pay (WTP) for green premiums, specifically focusing on their contribution to reducing carbon emissions generated by air travel. The research integrates the Theory of Planned Behaviour (TPB) and the Contingent Valuation Method (CVM) to estimate the monetary value that air passengers would be willing to pay for environmental initiatives. The TPB provides a theoretical framework to understand the psychological factors influencing individuals' intentions and behaviours, while the CVM allows for the estimation of the economic value of environmental goods. Drawing on the TPB, this study examines the influence of attitudes, subjective norms, and perceived behavioural control on air travellers' WTP for green premiums, while considering the determinants and barriers related to ecological goods, and sustainable consumption. The study investigates the potential economic implications of air travellers' willingness to pay for green premiums, particularly in the context of sustainable aviation fuel options and carbon-related fees. The findings of the survey of a sample of 248 respondents suggest a general willingness among passengers to pay for environmental premiums, notably carbon taxes, with variations in WTP influenced by demographics, travel preferences, environmental values, and awareness. Notably, younger travellers exhibit the highest WTP which is negatively related to the air ticket price. Higher environmental consciousness correlates with greater WTP. The impact of price perception and perceived efficacy of environmental initiatives were also found significant. Financial constraints and scepticism about the credibility of such premiums, however, limit some passengers' willingness to contribute.

Keywords willingness to pay; green products; sustainable aviation fuel; carbon offsetting; theory of planned behaviour

1. Introduction

The global aviation sector is poised for exponential growth, where the 4.5 billion scheduled passengers carried in 2019 are expected to grow to about 10.0 billion by 2040 [1].

The accelerating demand in air travel is anticipated to lead to a surge in airline seat capacity and the expansion of airports, inevitably contributing to carbon emissions. Aviation affects the global climate through both CO_2 and non-CO_2-induced effects. Globally, aviation accounts for around 2.5% of global CO_2 emissions, but 3.5% when we take non-CO_2 impacts on climate into account [2]. This substantial share in global emissions has raised considerable public concern and increased consciousness about the environmental impacts of air travel. Consequently, there is an increasing advocacy for the adoption of pro-environmental practices in the aviation industry.

To achieve the global aspirational goals of achieving Net Zero by 2050, and to promote sustainable growth of international aviation, the International Civil Aviation Organisation (ICAO) has initiated a basket of measures including aircraft technology improvements, operational improvements, sustainable aviation fuels (SAF), and market-based measures to implement the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) [3].

Despite these efforts, the challenge of balancing environmental sustainability with the economic and operational realities of air transport operations remains significantly difficult. Passenger awareness regarding the environmental impact of air travel has been increasing [4]. Airlines

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have begun introducing green options alongside basic fares [5], such as options for carbon offsetting or vegetarian in-flight meals. Several studies have examined the factors influencing consumers' willingness to pay (WTP) for green initiatives in various contexts, shedding light on the psychological, economic, and social dimensions of this issue. For instance, a study in 2019, explored the influence of personal choice and social pressure on the adoption of green practices in the hospitality industry, providing insights into the nuanced nature of WTP for environmentally friendly services [6]. Similarly, other scholars examined the WTP for green products in air travel, indicating that more passengers are willing to pay for green products [7]. This green segment is distinguished by behavioural features rather than demographic or socio-economic characteristics. Additionally, research suggested that WTP for sustainable aviation depends on ticket price, effective greenhouse gas reductions and gender [8].

Additionally, research on carbon taxes and consumers' WTP for green products has offered valuable perspectives on the economic implications and public acceptance of environmental levies, further enriching the discourse on WTP for sustainable practices [9]. Studies included the role of trust, service quality, and ancillary services in shaping passengers' attitudes and behaviours in the aviation industry, highlighting the interconnectedness of various factors influencing willingness to pay for green premiums [10,11]. Additionally, studies on energy efficiencies including optimising routes, reducing fuel consumption, and introducing biofuels have provided a comprehensive understanding of the technological and operational aspects of sustainable aviation, offering insights into the potential strategies for promoting green initiatives in air travel [12,13].

While plenty of studies have investigated the WTP for ecology-related products in different sectors, specific research focusing on airlines remains developing. There is a significant gap regarding the financial threshold passengers are prepared to invest in the extra green premiums. Therefore, this study aims to understand the psychological factors influencing individuals' intentions and behaviours to pay for green air travel products, while estimating the economic value of such environmental goods. This exploration is vital for understanding the economic feasibility of implementing substantial environmental strategies within the aviation industry.

The paper is structured as follows. First, the air transport industry initiatives for mitigating air travel emissions, literature on the WTP for green products, and the previous studies examining WTP for environment-related services in the aviation sector are reviewed. Second, based on the gaps identified in the literature review, the research questions are developed. Third, the research methodology and results are explained. Lastly, discussions of study findings and future research directions are presented.

2. Literature Review

2.1. Pro-environmental Initiatives for Mitigating Emissions in Aviation

The growth in air travel demand has been fuelled by rising disposable incomes and affordable prices offered by budget airlines [14]. Although the 2015 Paris Climate Agreement did not directly address air transport emissions, the International Civil Aviation Organisation (ICAO) initiated the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). This scheme, starting in 2020, aims for carbon-neutral growth, requiring airlines to either limit emissions or purchase credits from environmental projects to offset increased CO_2 emissions. CORSIA will be gradually implemented, starting with a voluntary phase from 2021 to 2023 and the first phase from 2024 to 2026, before becoming mandatory for most ICAO members from 2027 to 2035.

A range of initiatives have been proposed to mitigate carbon emissions in the aviation industry. In their study, Mayer & Ding [15] highlighted the importance of understanding the tensions and complementarities between international and state-level initiatives, such as those by the ICAO and individual countries. While a different study emphasises the potential of operational changes in the near term, technology retrofit and operational measures in the medium term, and the use of biofuels in the long term [16]. Williams [17] underscores the need for radical engineering solutions, including improvements in fuel efficiency and measures to reduce non-CO_2 impacts. Dray and his team [18] further explore the interaction between economic, technological, and operational measures and the potential impact of the European Union Emissions Trading Scheme on the uptake of these options.

Morell [19] has proposed various policies to reduce aviation emissions, including limiting flights, setting stricter standards for new aircraft and engines, switching to biofuel, promoting

voluntary carbon offsetting, and implementing emission taxes. Carbon offsetting allows airlines and passengers to compensate for their CO_2 emissions by supporting projects that reduce equivalent emissions elsewhere. While over thirty airlines globally have adopted carbon offset programs, only 1% of passengers choose to offset their emissions voluntarily [20]. As a result, it has been proposed that voluntary offset programs be supplemented with mandatory measures like carbon taxes [21].

2.2. Willingness to Pay for Green Initiatives in Air Travel

Several studies have explored the WTP for voluntary carbon offsets in aviation (e.g., [21,22], but fewer have investigated the WTP for mandatory aviation carbon taxes [23], and studies examining both are scarce. Passengers' understanding, and perception of carbon offset programmes significantly influence their WTP for such programmes [24]. Yet only 1–2% of international travellers participate in voluntary offsets, with participation being slightly higher in markets such as Australia [21]. This low participation rate, despite widespread environmental concerns among travellers, can be explained by the free-rider theory [25].

This theory also suggests that WTP for environmental improvements under voluntary programmes is generally lower than that under mandatory programmes, such as carbon taxes [26,27]. Travellers are more willing to pay for compensation accredited by reputable organizations [28]. In addition, emotional factors and social norms have a fundamental influence on purchasing decisions [29,30], as do demographic factors such as age, education, gender, and income, as well as the design of compensation programmes, particularly in terms of credibility and transparency [31,32].

However, the effectiveness of voluntary programmes has been questioned because of their low credibility and direct impact on reducing emissions [33,34]. Therefore, carbon taxes are considered more effective through levying it on aviation fuel or including it in ticket prices [35]. Economists argue that voluntary initiatives are less effective than emissions trading or mandatory taxes [36], often benefiting the airline's image and alleviating passengers' guilt without significantly reducing emission costs.

Several studies have investigated consumers' willingness to pay for green initiatives and found that they are willing to pay more for the use of renewable resources [37,38]. A study conducted in Switzerland that examined the WTP for pro-environmental initiatives in air travel using conjoint analysis indicated that 20% of travellers are willing to pay for these additional airline services, providing managerial recommendations for airlines seeking to implement sustainable practices [7].

Similarly, studies applied a choice modelling approach to measure the economic values of aviation carbon mitigation and identify major factors influencing air travellers' voluntary climate action [21]. A significant association was found in passengers' perceptions of support for a carbon price, flight contribution to climate change, effectiveness of voluntary offsets and domestic frequent flyers. The results showed no significant impact from socio-demographic backgrounds including professions, and educational levels.

Furthermore, investigating the impact of the COVID-19 pandemic on Malaysian airline passengers' WTP for carbon offset, highlighted the influence of external factors on passengers' environmental concerns and willingness to contribute to carbon offsetting initiatives [39]. The conclusion drawn indicates that most interviewed passengers believe that reducing the emissions from their travel is their responsibility and that they are willing to pay an additional fee for their airline ticket to contribute to reducing emissions.

Similarly, other studies explored the psychological benefits of green brands in an environmentally friendly airline context, highlighting gender as a moderating factor in passengers' green travel behaviour [40]. The results imply that the overall image of an environmentally friendly airline impacts the intentions to use, word-of-mouth, and willingness to pay more, while gender plays a moderating role in this relationship.

A study in 2018 examined British tourists' WTP airline passenger taxes, a carbon tax with environmental benefits [41]. They found a higher WTP for business class and long-haul flights. Studies on the impact of emissions taxes on the US aviation sector suggested possible compensation through increased automobile emissions [42]. While switching to high-speed trains in Sweden could significantly reduce CO_2 emissions [43].

A review of previous studies on WTP regarding voluntary and mandatory contributions to reduce CO_2 emissions shows mixed results with large variations [22]. Jou & Chen [44] reported

a low average WTP among Taiwanese passengers, while others found a higher average WTP among Malaysian passengers [45] and observed different WTP values for short- and long-haul flights in Europe [46]. There is little research on WTP for carbon taxes, and few studies provide some information highlighting different WTPs depending on flight type and nationality [23,41]. Although demographic factors have been studied extensively, less attention has been paid to the impact of flight type (domestic or international) on WTP [22].

2.3. Factors Influencing Green Consumption Behaviour

Under stringent environmental policies, airlines may transfer a part of the increased operating costs to passengers by increasing air ticket prices to compensate for their expenses. Airlines would likely pass all costs to passengers in more competitive markets, resulting in higher fares [47]. This might cause fares to increase by €0.02 to €5.32 per passenger due to the EU Emissions Trading System (ETS) [48]. Additionally, airlines would pass fuel costs to consumers through fuel surcharges [49]. Although carbon offsetting is voluntary, several studies found that some passengers support it [28,46,50]. Under demand management approaches, there are 23 European countries imposing flight taxes for air travel with an average charge of around 15 euros, which also causes an increase in airfares [51].

Consumers generally show a strong inclination towards supporting environmentally conscious and socially responsible companies, with 78.4% of consumers preferring products from such businesses [52]. In the tourism sector, 83% of global travellers consider travel sustainability important [53]. However, the support for environmental initiatives in aviation is notably lower. Only 20% of consumers are interested in green supplementary services within the aviation industry [7]. Despite the Aviation Environment Federation (AEF) emphasised that providing consumers with CO_2 data could increase awareness and informed decision-making [54], they found that carriers or aircraft rarely provide environmental-performance-related information to travellers, including aircraft age, seating density, and fuel burn efficiency [55]. De Smog [56] found that 90% of airline advertisements focus on prices and convenience rather than sustainability, contributing to the relatively low level of support for green initiatives in the aviation sector.

Consumers' green buying behaviours are affected by many factors. The most influential theory in sustainable consumer behaviours research is the Theory of Planned Behaviour (TPB) (Figure 1), which has been widely used in studying pro-environmental behaviours [57–59]. According to the theory, behavioural intentions are determined by attitude towards the behaviours, subjective norms, and perceived behavioural control.

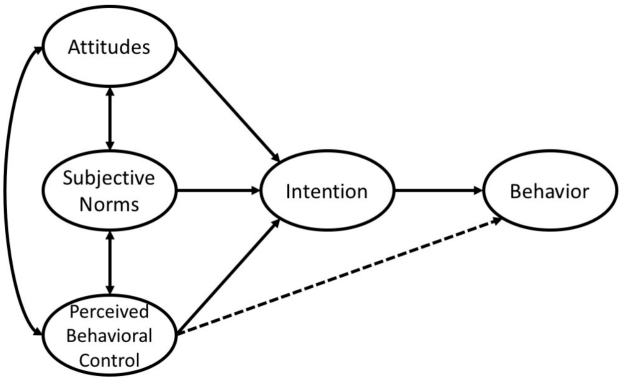

Figure 1. Theory of Planned Behaviour (Source [60]).

Attitude towards behaviours refers to people's beliefs and evaluations of the consequences of the performing behaviours, whether favourable or not [60]. Bandura [61] emphasises that individuals are motivated to act and persevere challenges when they believe their efforts will lead to desired outcomes. Subjective norms are another influential factor, which has been defined as perceived social pressure from others regarding engagement in specific behaviours [60]. When a social group promotes pro-environmental attitudes, individuals may feel pressured to conform to gain in-group identity [62]. Whereas, perceived behavioural control refers to the perceived difficulty of performing behaviours that are influenced by previous experience and expected impediments and obstacles [60].

2.4. Research Approaches of Willingness to Pay for Pro-environmental Services

Researchers studying WTP for environmental initiatives in air travel used a variety of approaches and techniques. Choice modelling studies have been utilised to measure the economic values of aviation carbon mitigation and identify major factors influencing air travellers' voluntary climate action [28]. Conjoint analysis has also been employed to assess the WTP for green products in air travel, providing insights into passengers' valuation of environmentally friendly initiatives. Additionally, Contingent Valuation Methods (CVM) have been used to understand tourists' stated WTP for certain benefits or to offset the damage caused to public welfare, offering a quantitative approach to understanding passengers' WTP for environmental initiatives [41].

As for data collection instruments, surveys and questionnaires have been used, employing methods such as face-to-face surveys and structured questionnaires for data collection [63]. The use of qualitative comparative analysis has also been highlighted as a method to understand how a combination of demographic variables, values, normative influence, personality traits, and beliefs can stimulate travellers' willingness to pay more [64]. The application of the TPB)has been employed to study WTP and its impact mechanism, affirming the validity and universality of this theoretical framework [65].

In addition to these methods, the use of double-bounded logit models has been utilised, providing a statistical approach to understanding consumers' valuation of environmentally friendly products [66]. Structural equation modelling (SEM) has been applied to assess environmental involvement and WTP more for environment-related fees as mediating variables between a multi-dimensional measure of environmental concern and sustainable behaviours, offering a comprehensive approach to understanding the relationship between environmental concern and WTP [67]. This study considers a range of contextual factors influencing the travellers' non-voluntary contributions to offset air travel-generated emissions. We presented different hypothetical scenarios of flights to evaluate the monetary amount that passengers are WTP as a share of the ticket price.

3. Methodology

3.1. Research Design

The study adopts a quantitative research design to assess travellers' WTP for compulsory environmental charges, such as biofuel surcharges and carbon taxes. The CVM will be used to understand passengers' preferences and how much they are willing to contribute to carbon reduction non-voluntary payments. Whereas the TPB to understand the individuals' attitudes, subjective norms, and perceived behavioural control as factors influencing their WTP.

The CVM has been widely applied to estimate the economic value of environmental goods and services, including WTP for various environmental features. The method involves directly asking individuals about their willingness to pay for non-market goods, providing valuable insights into the economic benefits associated with environmental amenities. The CVM has been applied in different contexts such as agriculture [68], tourism [41], and transportation [45]. The CVM, employed in our study, is a survey-based economic technique designed to estimate the value that individuals place on environmental services. It is utilised to assess air travellers' WTP for SAF surcharge and carbon taxes. This method involves presenting respondents with hypothetical scenarios wherein they are asked to state their WTP for the mentioned environmental initiatives. In our case, participants were provided with detailed descriptions of the SAF surcharge and carbon tax initiatives and then asked to indicate their WTP for these measures in the form of an additional fee. This approach allows us to gauge the perceived economic value of these environmental strategies from the perspective of air travellers, providing insight into consumer behaviour and preferences in the context of aviation sustainability.

The TPB is a widely used theoretical framework in social science studies, particularly in the fields of psychology, medicine, and environmental research. The theory aims to explain and predict human behaviour by considering attitudes, subjective norms, and perceived behavioural control. The TPB has been applied in the context of willingness to pay and environmental goods in sectors such as hospitality [69], sociology [70], and environmental behaviour [71].

3.2. Data Collection and Survey Instrument

An online questionnaire is developed using Qualtrics for data collection. The survey includes structured questions related to passengers' WTP for compulsory environmental charges, as well

as items assessing the constructs of the TPB, such as attitudes, subjective norms, and perceived behavioural control.

The questionnaire consists of twenty-seven questions distributed over six sections. The first section collects data related to demographic, income, level of education and region of residence. The second section includes questions to determine respondents' flying habits. The third section includes seven questions. It applies a Likert scale to investigate the constructs of the TPB and the respondents' environmental attitudes, subjective norms and perceived behavioural control through a series of statements touching on green goods' consumption.

The fourth section is based on CVM techniques that use different scenario questions to determine the monetary value of the SAF surcharge and carbon taxes and explore the respondents' WTP levels. The following CVM techniques are combined [72]—Payment Card (PC), Open Ended (OE), and Dichotomous Choice (DC), while acknowledging CVM's hypothetical nature [73] and its limitation in determining maximum WTP rather than actual WTP [74]. The respondents are offered different scenarios of flights from London to Hong Kong with different CO_2 emissions and SAF fuel surcharge rates (0%, 5%, 10%, 15%, 20%). The PC method is used to present these varying rates and emissions, while the OE method is employed when participants choose the highest premium, allowing them to input their own price. This combination helps balance biases, with PC providing a baseline for informed OE responses. The WTP for carbon taxes has been evaluated using the DC method, focusing on passenger responses to different tax rates without considering effectiveness. Tax scenarios presented include an increase from 5% to 15%, and potentially higher or lower rates based on willingness to fly, exploring participant reactions to varying tax burdens.

The fifth section of the questionnaire evaluates the motivations and barriers of the decision-making process for contributing to emission reduction initiatives. The final section includes open-ended questions allowing respondents to provide recommendations on how airlines could better address environmental concerns.

The questionnaire was carefully reviewed by two faculty members whose main research focus is the airline industry, three post-graduate research students with relevant industry experience, and three airline professionals. The questionnaire uses a five-point Likert-type scale, ranging from strongly disagree (1) to strongly agree (5). The revised questionnaire was pre-tested with 30 travellers. Reliability checks for the measurement items were conducted through Cronbach's alpha. The results indicate that reliability was satisfactory, with Cronbach's alpha of all constructs over 0.70 [75].

The survey questionnaire was then distributed to travellers who had taken a flight up to 12 months prior to the survey. The study adheres to ethical guidelines for research involving human subjects. Informed consent was obtained from participants while ensuring their privacy and confidentiality. The survey clearly communicates the purpose of the study and provides participants with the option to withdraw from participation. The questionnaire was circulated via social media professional platforms between 15 February and 30 April 2023 and targeting air travel services relevant groups. We received 273 responses that were subject to multivariate outliers' checks. Finally, 248 usable responses were used for analysis.

3.3. Sample Characteristics

A convenience sampling approach is utilised to recruit participants for the online survey. The sample includes a diverse representation of airline passengers in terms of demographics, income and education levels, travel frequency, and environmental attitudes.

Table 1 shows the respondents' demographic profile. The number of respondents is relatively balanced by gender, with 44.4% female and 53.2% male. Approximately 53.2% of respondents are between the ages of 18 and 34, while the remaining 46.8% are 35 or above. Respondents' highest education level was evenly distributed among high school, bachelor's degree, and master's degree or PhD, where more than half of the respondents had completed university education. Nearly 60% of respondents are employed in the private and public sectors, while around 23% are students. Approximately 30% of respondents reported their annual income is below £12,000. Considering some respondents are unwilling to disclose their income range, a question about the ownership of the property was asked to provide insights into their financial status. Around 53% of respondents do not live on the property that they own. More than half of the respondents (55%) are single with no children. Geographically, respondents are distributed

across world regions with the highest representation from Asia Pacific & Oceania with almost 43%.

Table 1. Characteristics of survey respondents (n = 248).

Variable		***Percentage***
Gender	Male	53.2%
	Female	44.4%
	Prefer not to say	2.4%
Age	18–34	53.2%
	35–44	12.1%
	45–54	14.5%
	55–64	19.4%
	65 or above	0.8%
Education Level	Primary school	0.8%
	High school	29.8%
	Diploma/Technical Education	15.3%
	Bachelor	28.2%
	Master/PhD	25.8%
Occupation	Private sector	38.7%
	Public sector	19.4%
	Freelancers	4%
	Part-timer	4%
	Unemployed	7.3%
	Retired	4%
	Student	22.6%
Annual Income	Below £12,000	29%
	£12,000–£25,000	13.7%
	£25,000–£40,000	18.5%
	£40,000–£55,000	3.2%
	£55,000 or above	10.5%
	Prefer not to say	25%
Household Type	Single, no children	55.3%
	Single, with children	1.6%
	Couple, no children	8.9%
	Couple, with children	34.1%
Property Ownership	Yes	37.1%
	No	52.4%
	Prefer not to say	10.5%
Region of Residence	Asia Pacific & Oceania	42.7%
	Middle East	8.6%
	Europe	31.4%
	Africa	6.1%
	Americas	11.2%

3.4. Data Analysis and Limitations

Descriptive statistics will be used to analyse respondents' willingness to pay for compulsory environmental charges. Regression analysis is utilised to examine the relationship between the TPB constructs, environmental awareness, socio-economic and demographic variables, and the WTP. Three techniques of the CVM method are applied to estimate the mean WTP and analyse the distribution of willingness to pay values. Potential limitations of the study may include sample representativeness, self-reported data, and the influence of external factors, such as economic conditions and regulatory changes. The study will acknowledge these limitations and interpret the findings accordingly.

4. Findings and Discussion

4.1. Environmental Attitudes, Social Norms, and Perceived Behavioural Control

To identify respondents' behavioural intentions, the constructs of the TPB were applied. Respondents were asked seven questions about their attitudes towards green product consumption, social pressures reinforcing green buying decisions, and finally the perceived capacity of executing such decisions. The findings indicate that less than half of the respondents (40%) hold positive attitudes towards green purchases and answered with agree and strongly agree for questions related to buying environmentally related goods. Whereas the majority (58%) suggested that they are not influenced by peer or social pressure when making green consumption decisions. Regarding the perceived ability to contribute to reducing emissions of air travel through purchasing green products, only 36 percent expressed their positive perceptions about the affordability of green choices and their capacity to implement them.

The results of the environmental attitudes are in line with literature investigating consumers' attitudes, purchase intentions, and environmental concerns that positively affect their perception of sustainable behaviour and willingness to pay more for environmentally friendly products [61]. Conversely, the finding contradicts with previous application of the TPB constructs which indicated that environmental concerns significantly affect attitude, perceived behavioural control, and purchase intention for green products [76].

4.2. Environmental Awareness and Knowledge about Airline Environmental Initiatives

To assess environmental awareness levels, knowledge about airline carbon reduction programmes and confidence in environmental mitigation investments, respondents were asked a number of questions as shown in Table 2.

Table 2. Environmental awareness, knowledge and confidence about sustainability investments.

Variable	Frequency	Percentage
I am alarmingly concerned about climate change.	71	28.6
Air travel significantly contributes to climate change.	59	23.7
I believe that individuals have a role to play in reducing the environmental impact of air travel.	43	17.3
I am aware of the concept of carbon offsetting.	17	6.9
I am aware of sustainable aviation fuel.	22	8.8
I usually consider the environmental policies of an airline when choosing who to fly with.	3	1.2

The results revealed that half the number of the respondents (52%) are concerned about climate change and the carbon footprint of air travel. Only 1% consider airline environmental initiatives before selecting their carrier. In total, 16% are aware of airline carbon reduction programmes (SAF and CO_2 offsetting). While 20% of the respondents show confidence in the effectiveness of airline sustainability investments.

Further inquiry into the respondents' personal engagement with flight offsetting reveals that although the pro-environmental sentiment is high, actual participation in offsetting programmes is notably low, with under 30% reporting previous offsetting actions (Figure 2). This discrepancy between perceived values and actions is critical, highlighting a potential barrier to the translation of environmental values into behavioural change. However, there is an indicated potential for future behavioural alignment, with half of the respondents signalling a willingness to consider flight offsetting moving forward. This willingness presents an opportunity for policymakers and industry stakeholders to develop strategies that bridge the gap between environmental values and awareness, leading to increased participation in environmental initiatives.

The findings are supported by literature suggesting that environmental values and knowledge have increased consumers' willingness to pay for green initiatives, such as organic menus, wastewater treatment services, and low-carbon transport [77–79].

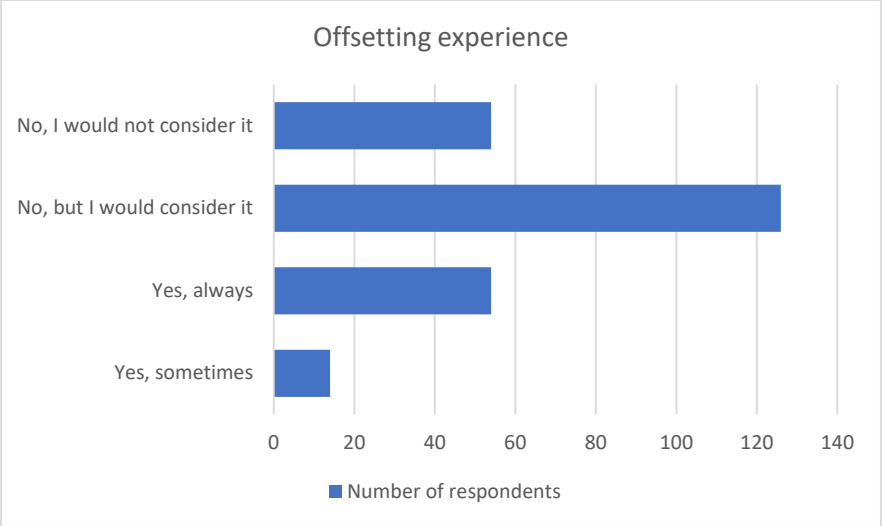

Figure 2. Responses to flight offsetting experiences.

4.3. Estimation of Willingness to Pay

The findings reveal nuanced perspectives among passengers concerning their WTP for sustainable aviation initiatives. When it comes to SAF, a significant portion of the survey's respondents, amounting to 34%, are amenable to a 5% surcharge on their ticket prices to support airlines that utilise SAF. Conversely, a similar proportion, 33%, are resistant to any additional fees. Notably, as the proposed surcharges escalated, the proportion of passengers willing to contribute correspondingly diminished. An interesting observation from the survey was that two individuals indicated a readiness to pay even beyond the highest surcharge options presented in the survey.

In contrast, attitudes toward carbon taxes for environmental protection measures diverged from the trend observed for SAF surcharges. The study found a greater propensity among passengers to accept higher carbon taxes, with the majority expressing a willingness to accommodate the highest proposed tax increment of 20% on their fares. This suggests that the ceiling for carbon tax rates in the survey might have been underestimated, possibly constraining the respondents' range of choices. Remarkably, the study also highlighted an all-or-nothing approach to carbon taxes: respondents who declined the initial tax proposal tended to reject any form of tax increase altogether, as evidenced by the absence of any inclination to accept a moderate 10% tax rate. This dichotomy in passenger responses to SAF surcharges and carbon taxes provides valuable insights into consumer behaviour and preferences regarding different environmental levies in the aviation sector.

4.4. Motivators and Barriers for Willingness to Pay

Respondents were tasked with ranking various motivators according to their perceived influence on their WTP. The results were the following: ticket price emerged as the paramount concern influencing WTP, while the perceived effect of the environmental initiatives was deemed the least impactful.

Utilising one-way Analysis of Variance (ANOVA) to determine the relationship between these motivating factors and passengers' WTP for SAF surcharges, a significant association was identified. This aligns with previous research recognising price as the foremost factor affecting consumer WTP [62]. Conversely, when considering carbon taxes, the analysis revealed that these motivating factors held no significant relation to passengers' WTP.

When addressing the barriers preventing respondents from supporting additional environmental costs, multiple reasons were cited. Among those who are reserved to pay for environmental premiums, financial constraints were commonly reported, with 10 out of 15 respondents indicating that their economic circumstances prohibit them from contributing to such premiums. Additionally, six respondents reflected scepticism about the actual impact of their monetary contributions to environmental efforts. Moreover, a sentiment was expressed by four respondents that the responsibility of fostering sustainability in aviation should fall on the airlines themselves, rather than being passed on to passengers as additional costs. This reveals that performance risk

(effectiveness) and financial risk (cost) have been found to impact consumers' willingness to pay more [80].

4.5. Demographics, Socioeconomic Variables and Flying Habits

The exploration of the correlation between demographic factors and flying habits in relation to passengers' WTP for SAF surcharges and carbon taxes revealed some significant trends. Age and income are moderately and positively correlated (r = 0.344), with the likelihood of WTP increasing with both age and income, as reflected in the statistical significance ($p < 0.05$). Additionally, there exists a significant, albeit weaker, positive correlation between age and WTP for SAF surcharges (p = 0.008, r = 0.258). This may suggest that older passengers, due to potentially limited exposure to aviation-specific environmental initiatives could have a lower WTP for SAF [81]. Additionally, younger individuals are more adept at seeking information online, which could influence their understanding and hence their WTP [82].

In contrast, no significant correlation was observed between age and WTP for carbon taxes, possibly due to the more pervasive understanding of taxation as a concept that extends beyond the aviation industry into being a universal concept. Moreover, the lack of a significant relationship between income levels and WTP for green airline products challenges the hypothesis that higher income correlates with higher WTP. This could be attributed to the fact that approximately 30% of respondents are students or retired individuals with annual income below £12,000, who may receive family support to finance their trips by air, rendering environmental premiums within their financial reach.

Regarding flying habits, the study found no significant correlation between travel frequency and WTP for SAF and carbon taxes. Similarly, average fare expenditure did not correlate with travel frequency or WTP for carbon taxes. However, a weak positive relationship was noted between fare expenditure and WTP for carbon taxes (p = 0.033, r = 0.223), suggesting that passengers who spend more on fares may be slightly more inclined to pay for carbon taxes.

The study also employs regression analyses to examine relationships between various independent variables and WTP for SAF and carbon taxes. The cohort of age group 18–34 was found significant, showing a higher WTP for SAF surcharges (coefficient = −0.955), thereby confirming the hypothesis that younger passengers are more willing to contribute to environmental surcharges.

Looking at the average spending on fares and attitude toward behaviours, the regression analysis, as shown in Table 3, reveals that both factors significantly affect WTP for SAF. A higher environmental attitude leads to a greater WTP (coefficient = 0.953), and passengers spending less on their fares are more inclined to accept higher premiums (coefficient = −2.018). This suggests a nuanced interplay between the cost of airfare and passengers' environmental conscientiousness.

Table 3. Ordinal regression analysis for passengers' WTP for SAF and their attitude and average spending on fares.

		Estimate	Std. Error	Wald	df.	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[SAF = 0.00%]	2.241	1.067	4.407	1	0.036	0.149	4.333
	[SAF = 5.00%]	3.925	1.122	12.240	1	<0.001	1.726	6.124
	[SAF = 10.00%]	5.361	1.182	20.571	1	<0.001	3.044	7.677
	[SAF = 15.00%]	6.164	1.232	25.023	1	<0.001	3.749	8.579
	[SAF = 20.00%]	7.879	1.532	26.459	1	<0.001	4.877	10.881
Location	Attitude	0.953	0.279	11.637	1	<0.001	0.406	1.501
	Average spending: Below £100	−2.018	0.901	5.023	1	0.025	−3.784	−0.253
	Average spending: £101–£250	−0.441	0.560	0.620	1	0.431	−1.538	0.656
	Average spending: £251–£400	−0.186	0.590	0.100	1	0.752	−1.343	0.970
	Average spending: £401–£650	−0.283	0.663	0.182	1	0.670	−1.583	1.017
	Average spending: £651 or above	0	-	-	0	-	-	-

The impact of occupation and household type on WTP was explored with One-way ANOVA indicating no significant differences across occupational groups. In contrast, significant variations were identified between household types, particularly when distinguishing between households with and without children. Results from independent samples t-tests, consolidated into two subgroups, support the assertion that passengers with children demonstrate a significantly higher WTP for SAF, emphasising the role of family dynamics in environmental investment decisions [61].

Additionally, the Kruskal-Wallis test highlighted no significant association between education level and passengers' environmental values or awareness, as indicated by a p-value exceeding 0.05. This suggests that education level may not substantially influence these factors, indicating a need for further research to interpret the determinants of passengers' environmental values and awareness.

5. Conclusions

This research focuses on passengers' WTP for SAF surcharges and carbon taxes and uncovers intricate patterns in consumer behaviour toward aviation's environmental sustainability measures. Despite the aviation industry's commitment to sustainability, the resulting operational costs are often transferred to passengers, thus necessitating a deeper understanding of their WTP. The research integrates the TPB and the CVM to estimate the monetary value that air passengers would be willing to pay for environmental initiatives. Data was collected through an online survey, and 248 useful responses were analysed. The survey consists of six sections and 26 questions capturing TPB constructs, and the monetary estimation of payments for green premiums.

The study reveals that passengers demonstrate a higher WTP for carbon taxes than for SAF fuel surcharges. More than 30% are reluctant to pay extra for SAF, with 45% willing to bear a less than 10% premium. In contrast, more than 60% of the respondents are amenable to a 15% increase in carbon taxes, with 83% willing to accept a 20% premium. This disparity may stem from varying levels of understanding of the policies, noting a general unfamiliarity with aviation environmental initiatives among passengers [4]. The concept of carbon taxes, being more ubiquitous and understood, seems to garner greater acceptance.

Employing the TPB as a framework, this study finds that, while attitude significantly impacts WTP for SAF surcharges, subjective norms and perceived behavioural control do not. This aligns with the literature suggesting that positive environmental attitudes correlate with a higher WTP [83,84]. However, the TPB does not fully account for the variance in the WTP for compulsory aviation environmental premiums.

Additional variables, including environmental values, demographic factors, and flying habits were also examined. Significant relationships were found between environmental values, age, and average fare spending, with younger passengers and those spending less on fares showing a higher WTP for SAF. The presence of children in households has emerged as a critical factor, reflecting concerns about the environmental impacts on future generations [62,63,85]. However, gender did not significantly correlate with WTP, contrary to the findings of previous studies [20]. It is noteworthy that, while these factors influence WTP for SAF surcharges, the determinants of WTP for carbon taxes remain elusive.

This study provides insights for airlines and policymakers, emphasising the need to enhance the understanding and acceptance of SAF. This suggests the targeted promotion of aviation's environmental impacts and SAF's potential, alongside efforts to dispel the notion that environmental premiums are prohibitively expensive. This research also underscores the importance of transparency in environmental initiatives and tailoring communication strategies to address the diverse needs of different age groups.

The study acknowledges a key limitation in the form of its relatively small sample size (n = 248), which poses constraints on the global representativity of our findings. While the sample was carefully chosen to provide initial insights, its limited scope may affect the interpretability and broader applicability of our results. Consequently, the generalisations drawn from this research should be approached with caution, particularly when extrapolating to different or larger populations. Another limitation is the predominantly Asian-based participants and lack of business traveller representation. Brouwer et al. [86] highlight a lower awareness of aviation's climate impact in Asia, which may skew results. Furthermore, the absence of factors influencing WTP for carbon taxes and the potential underrepresentation of the maximum WTP levels warrant

further investigation. Nonetheless, the results obtained offer valuable preliminary insights, setting a foundation for more extensive inquiries in this area.

Future research could broaden its scope to include diverse global participants and employ mixed methods to uncover additional factors that influence WTP. A comparative analysis across different countries and increased options for carbon tax premiums could provide a more comprehensive understanding of passengers' attitudes towards both SAF surcharges and carbon taxes.

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Data Availability

Data supporting the results reported in the paper are available upon request.

Author Contributions

Conceptualization: T.H.; Data curation: T.H., & N.I.; Formal analysis: T.H., N.I., & J.F.O.; Methodology: T.H.; Supervision: N.I.; Writing – original draft: T.H., N.I.; Writing – review & editing: T.H., N.I., & J.F.O.

Conflicts of Interest

The authors have no conflict of interest to declare.

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