1. INTRODUCTION

Growth in air travel comes with a cost with respect to carbon dioxide (CO_2) emissions from airport operational activities (Milner, Rice and Rice, 2019), access/egress transport (Miyoshi and Rietveld, 2015) and flights. Although the new generation of aircrafts have significantly lower fuel consumption than previous generations, claims have been made that aviation's contribution to global emissions will rise to 22% by 2050 (Cames et al., 2015). International aviation is not included in the Paris Agreement, and effective international policies to curb emissions generated by air travel is missing. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), initiated by the International Civil Aviation Organization (ICAO), requires airlines to stabilize emissions at the 2020 level, but this implies only a carbon neutral growth after 2020, no actual reduction of emissions. The EU emission trading system (ETS) defines limits for carbon emission from intra-European flights. However, more than 80% are allocated to the airlines free of charge, and the ETS has little to no impact on pollution abatements costs (Cui, Li & Wei, 2017). Larsson et al. (2019) conclude that the ETS and CORSIA initiatives only have marginal effects on carbon emissions from Swedish air travelers.

At the individual level, research (e.g., Higham & Cohen, 2011; Ryley et al., 2010) has documented an increasing awareness of the impact of aviation and tourism on global emissions and climate change. Flying is "…a tourist's most serious environmental sin" (Debbage & Debagge, 2019, p. 10), and a growing tension seems to exist between the personal welfares associated with air travel and the negative environmental consequences of aviation producing a cognitive dissonance referred to as "the flyers' dilemma" (Higham et al. 2014; Young et al. 2015). However, the increased awareness of environmental consequences and attitudinal concerns has had limited effect on actual behaviors to reduce leisure air travel and tourism demand (Cocolas et al., 2020; Cohen et al. 2016). Rather, there is a widely-held opinion that such responsibilities for the environmental impacts of travel practices lie with governments and the business, not the individual traveler (Higham et al., 2014; Hares, Dickinson & Wilkes, 2010). The disclaim of individual responsibility is also reflected by the low uptake of voluntary carbon offsets (VCOs) for air travel, as are offered by many airlines (Choi, Gössling & Ritchie, 2018; McLennan et al., 2014).

The absence of international agreements and, as well, a lack of motivation in consumers to change their behavior and/or offset emissions caused by air travel, has resulted in domestic policy initiatives serving as a primary source for climate regulations within this sector. Some European countries, including Germany, UK, Sweden and Norway, have introduced a carbon tax on air travel. Such taxes have been criticized by the tourism industry as potentially negatively influencing tourism demand. The airline industry claims that national initiatives have little environmental impact, since capacity can be moved to other markets; moreover, aggressive competition makes it difficult to pass the tax on to passengers. However, research (e.g., Choi & Ritchie, 2014; MacKerron et al., 2009) has found support among many airline passengers for carbon taxes, and some see increased taxation of air travel as inevitable and overdue (Higham et al., 2016). This suggests that some market segments have a high acceptability for carbon taxes on air travel, and that tourism industries might be too pessimistic when assessing tourists' willingness to pay (WTP) to compensate for negative externalities caused by air travel.

The majority of previous studies examining WTP have dealt with VCOs, while little research has investigated air travelers' WTP for mandatory carbon taxes on air travel (Seetaram et al., 2018; Jou & Chen, 2015). For policymakers, the latter approach is the most relevant, since they need information on the actual amounts air travelers are willing to pay to compensate for negative externalities. A challenging aspect of VCOs is that both participation and WTP are dependent on "burden sharing" by fellow travelers (Araghi et al., 2014), while mandatory taxation schemes apply to all travelers. Moreover, research suggest that respondents state a somewhat higher WTP for collective payment mechanisms compared to voluntary payment mechanisms (Sonnenschein & Mundaca, 2019; Wiser, 2007), suggesting that, in the context of air travel, VCOs might underestimate air passengers' true willingness to pay for externalities. It is further recognized that air travelers' WTP for carbon taxes varies by individual and contextual factors, such as age, gender, trip purpose and income (Seetaram et al., 2018; Sonnenschein & Smedby, 2018; Gupta, 2016; Jou & Chen, 2015). On the other hand, few studies have investigated the impact of different taxation schemes on WTP estimates for carbon taxes, and little consensus has been reached about their viability. Choi (2015) suggests that the literature provides few empirical studies examining monetary values of carbon offsets in the aviation sector. What form carbon taxes should take and how they can be made acceptable to the individual traveler is thus still an open question (Higham et al., 2016). Altogether, market acceptance for carbon emission taxes is underresearched.

The present study is set in Norway. Norway is an interesting case since a carbon tax on air travel has been active for some years.[1] The objective was to investigate whether international leisure air travelers will accept higher carbon taxes than what is already a part of the ticket price. International leisure travel was chosen as the study context since this is the fastest-growing market segment; further, research has shown that WTP to carbon-neutralize international flights is less than for domestic flights (Choi, et al., 2018; Choi & Ritchie, 2014; Higham & Cohen, 2011). The impact of eight hypothetical taxation schemes are tested in an experimental design to provide insight into how regulatory policies can be developed so as to improve acceptance of carbon taxes among air travelers. The study adds to the extant literature by providing estimates of the market tolerance for carbon taxes on air travel; it also improves knowledge of how taxation schemes can be developed to increase their acceptance by travelers. The following research questions specify the study purpose:

1. How much more are Norwegian leisure air travelers willing to pay in compulsory carbon taxes?
2. Does WTP vary according to taxation scheme, destination, fare, and/or individual factors?

2. LITERATURE REVIEW

2.1 Willingness to pay carbon taxes

The majority of academic research on airline passengers' attitudes towards carbon taxes has examined uptake of voluntary carbon-offsetting programs (VCO). These give air travelers the opportunity to neutralize their proportion of the aircraft's carbon emissions by paying an extra fee to a third-party carbon-reduction project. Several studies have found that many air travelers are willing to pay VCOs in principle (Choi & Ritchie, 2014; MacKerron et al., 2009) and that WTP estimates for carbon offsetting often exceed the supply price for CO_2 (e.g., Lu and Shon, 2012; Brouwer, Brander, & Van Beukering, 2008). Still, the actual adoption of VCOs in aviation is low, commonly in the range from 2% to 10% (Choi & Ritchie, 2014; McLennan et al., 2014; Gössling et al., 2009). Studies (e.g., Araghi et al., 2014; MacKerron et al., 2009) have found that more air travelers could be convinced to pay carbon taxes, but only if fellow passengers participate and "share the burden." This crowding-in effect is well documented in studies of environmental behavior (Schultz et al., 2016; Nolan et al., 2008; Schultz et al., 2007). It can be explained by the norm of reciprocity, i.e., the expectation that positive actions will be met with positive responses, and vice versa (Biel & Thøgersen, 2007). The low uptake of VCOs suggests that reciprocal norms are more or less absent in air travel and that air passengers are generally not motivated to carbon offset their journey since fellow travelers are not likely to do so either. To stimulate and sustain contribution to public goods,

[1] The air-passenger fee of NOK 80 (app. $9) was introduced on all departures from Norwegian airports in 2016. In 2018 it was raised to NOK 83, and then to NOK 84 in 2019. The fee was the same for all national and international destinations. However, on April 1, 2019, a differentiated fee was introduced, set to NOK 75 for flights to national and most other European destinations (except Turkey and Caucasus) and NOK 200 for intercontinental flights (Norwegian Tax Administration, 2019).

a sufficiently high proportion of individuals must be reciprocally motivated (Fehr & Gächter, 2000). Indicative findings in relation to VCOs in aviation suggest that the collective offsetting rate must be in the range of 50–90% (Araghi et al., 2014), which is well above current adoption levels.

Although findings indicate that social norms has become a stronger driver of VCO in recent years (Ritchie et al., 2020), VCOs still appear to be an insufficient mechanism to mitigate emissions from air travel. The criticism has also been made that they may be a cheap way for people to feel better about the emissions caused by their flights; in such as manner, they might actually be a disincentive to changing one's travel behavior (Metz et al., 2007). With current carbon prices, offsetting a return flight from London to New York on United Airlines will add an extra $10.44 to the ticket price (United Airlines, 2019). On the other hand, mandatory carbon taxes such as the air passenger duty in Norway apply to all travelers, including those unwilling to pay voluntary offsets. Since all travelers "share the burden" the problem with free riders is avoided.

However, mandatory carbon taxes on air travel are controversial since they represent an export tax that makes the country more expensive and less competitive as a tourism destination. Thus, there are major industry concerns about imposing carbon taxes on air travel, both in Norway and elsewhere (e.g., Forsyth et al., 2014).

A few studies have investigated air travelers' WTP for mandatory carbon taxes. These include Seetaram et al. (2018), who found that UK travelers' WTP for the air passenger duty tax (ADP) was in the range of £16,54 to £36,79, depending on flight distance and class (economy or business class). The highest WTP was for long-haul business class trips, whereas short-haul economy class trips had the lowest WTP. The WTP for short-haul trips was higher than the actual ADP at the time, while it was lower for long-haul journeys. In a similar study, Sonnensschein and Smedby (2018) reported that more than 70% of the respondents had a positive WTP to compensate for travel emissions. Again, absolute WTP was higher in the long-haul context than for short-haul journeys, but WTP per ton CO_2 was significantly higher in the short-haul context. These studies indicate that many airline passengers would accept a carbon tax provided that it applies to all travelers; that WTP may, in fact, exceed current taxation levels.

2.2 Regulatory schemes

While economists generally maintain that government income and spending should be separated, the legitimacy of environmental taxes can be reduced if their use is not specified and clearly understood by the public. Policymakers are therefore facing the dilemma of earmarking environmental taxes or spending the incomes for general government expenditures. Using data from a representative sample of the Norwegian voter population, Sælen and Kallbekken (2011) found a strong preference for earmarking incomes from a hypothetical fuel tax increase, as opposed to using the additional revenues for general fundraising. Moreover, earmarking for environmental measures was preferred to earmarking for other purposes. Results showed that people were willing to accept a fuel tax increase of 15% if the additional revenues were used for measures supporting environmentally friendly transport. In contrast, earmarking for income redistribution (i.e., lowering of income taxes for low-income households) did generally not increase support sufficiently to make tax increases acceptable. The authors explained the earmarking preference by "issue linkage," i.e., acceptance of an environmental tax will be higher when there is a strong link between the taxed activity and the spending cause. Dresner, Jackson and Gilbert (2006) provided the same argument when they claimed that people have difficulties understanding and accepting the double dividend argument wherein environmental taxes are used to lower, for example, income taxes. Rather, respondents in their study strongly preferred that tax revenues would be used "…on measures that they could understand such as developing renewable energy and improving energy efficiency" (p. 938).

Based on these arguments, one would expect a general preference among air travelers for earmarking the revenues from carbon taxes. In Seetaram et al.'s (2018) study of the air passenger-duty tax in the UK, the authors reported that about one-third of the respondents were in favor of spending the revenues on “environmental projects”, while only 6% preferred “general government expenditures” (p. 91). Other possibilities included “airport development” and “tourism-related projects” (p. 93). Correspondingly, Sonnenschein and Smedby (2018) found a positive impact on WTP of earmarking tax revenues for “climate change mitigation or sustainable transport solutions” (p. 8). Although these and other studies referred above found that public acceptance for environmental taxes increases when tax incomes are earmarked, Seetaram et al. (2018) noted that a challenge in introducing or increasing carbon taxes in aviation is to communicate how the revenues are to be used. Earmarking for “environmental projects” is vague and leaves the receiver with little information on the specific use of the tax revenues. Accordingly, the present study links earmarking of tax incomes to ongoing environmental projects or initiatives that have been on the political agenda and subject to public debate in Norway.

2.3 Factors influencing WTP

Past research has identified several determinants for tourists’ and air travelers’ WTP for carbon offsetting. Generally, such studies have looked at sociodemographic, psychographic, and behavioral variables, including gender, age, education, income and environmental attitudes/consciousness and travel frequency. The literature presents no conclusive evidence on the impact of sociodemographic factors. In the study of Choi and Ritchie (2014), gender, job, age, and income all showed no significant effect on respondents’ WTP for flying carbon neutral. Other studies (MacKerron et al., 2009; Mehmetoglu, 2010) have reported that women display more environmentally-supportive behavior than men, while age has been found to be negatively related to WTP (Seeteram et al., 2018; Segerstedt & Grote, 2016; Lu & Shon, 2012). Concerning education and income, there is no conclusive evidence to support the general assumption that WTP for environmental measures is positively related to higher levels of education and income (see Seetaram et al., 2018). On the other hand, research is fairly robust concerning the impact of psychographic factors: support for environmental policies, environmental consciousness, feelings of personal responsibility of carbon emissions, and knowledge of aviation impacts all have been found to increases approval for environmental taxes and WTP (Lu & Wang, 2018; Sonnenschein & Smedby, 2018; Baranzini & Carattini, 2017; Sælen & Kallbekken, 2011). Perhaps not surprisingly, support decreases with higher levels of air travel frequency (Kantenbacher et al., 2018; Higham et al., 2016).

The impact of travel motives has received scant attention in the literature on carbon offsetting. However, this is a highly relevant factor, since people have different motives for going on a vacation and different destinations attract different types of tourists. It is common to distinguish between two principal types of vacation travel motives (Dann, 1977): “Push motives” relates to the home community and/or the travel party, whereas “pull” motives correspond with destination attributes that attract visitors or potential tourists. The “push factor” generally embraces internal, psychological aspects such as the desire to escape and need for rest and relaxation, whereas the “pull factor” expresses external, situational, or cognitive forces which include a destination’s attractiveness (e.g., beaches, natural scenery, etc.), infrastructure and cultural features (Crompton, 1979; Uysal & Jurowski, 1994; Yoon & Uysal, 2005). Thus, people are both pressed into travel by internal, emotional forces and are attracted by external forces related to destinations.

A general assumption in the present study is that WTP for carbon taxes will increase/decrease depending on the traveler’s motivation to make the journey, since vacation travel motives reflect the personal values of the individual (Li & Cai, 2012; Madrigal & Kahle, 1994). Scattered empirical research on travel motives and WTP for environmental measures support this assumption. For instance, do Valle et al. (2012) identified different segments to a sun and beach destination in Portugal, and found that tourists’ who preferred traditional beach recreation (swimming, diving, getting a tan) were less willing to pay an environmental protection tax than were nature-oriented tourists. McLennan et al. (2014) also report that visitors to Australia who participated in nature-based activities were more likely to carbon offset their journey than other visitors.

3. METHODOLOGY

3.1 Study data

The study was based on an experimental design where participants were recruited from the Norstat Internet panel in Norway. The sample comprised adults who had made international flights for leisure purposes during the past 12 months. Study participants should answer a questionnaire comprising three main sections. The first included demographic characteristics, and information about the latest international journey made for leisure purposes (origin and destination, travel motivations, number of traveling companions, duration of stay, and total flight costs for the flight for the traveling party). The second section covered contingent valuation (CV) questions designed to tap respondents' WTP for carbon taxes (described below); the last section included questions on attitudes towards taxation and earmarking. The content of section 1 and 3 was common to all participants, whereas for sections 2 (CV questions), participants were randomly assigned to one of eight experimental groups (see below). Table 1 lists the variables applied in the analysis, including demographic characteristics of the sample.

Table 1. Descriptive statistics of the sample of Norwegian leisure air travelers (N=878)

Variable	Mean	*SD*	Min.	Max.	Median
Share of yes to first bid	0.3542	0.4785	0	1	0
Share of certain yes to first bid	0.1344	0.3413	0	1	0
Share of yes to second bid	0.4920	0.5002	0	1	0
Share of certain yes to second bid	0.1276	0.3338	0	1	0
Variable fee in scenario	0.4920	0.5002	0	1	0
Earmarking – rainforest	0.2506	0.4336	0	1	0
Earmarking – biofuel	0.2460	0.4309	0	1	0
Earmarking - high-speed train	0.2472	0.4316	0	1	0
Female gender	0.4567	0.4984	0	1	0
University degree	0.6876	0.4637	0	1	1
In full-time work	0.5467	0.4981	0	1	1
Age	48.18	16.79	18	89	48
No. of household members	2.33	1.20	1	10	2
Household income, gross annual (NOK)	860,251	431,146	150,000	2,250,000	900,000
Flight cost (NOK)	9613	9412	500	72,000	6400
Flight cost level 1 (NOK)	2774	998	500	4500	3000
Flight cost level 2 (NOK)	6632	1451	4600	9600	6400
Flight cost level 3 (NOK)	19,433	10,451	10,000	72,000	16,000
Northern European destination	0.3622	0.4809	0	1	0
Southern European destination	0.5000	0.5003	0	1	1
Intercontinental destination	0.1378	0.3449	0	1	0
Shop and party	0.0023	0.6378	-1.2659	1.6952	0.0538
Contacts abroad	0.0266	0.6716	-0.8922	1.9555	-0.0199
Escape and relax	-0.0093	0.5895	-1.5918	1.4416	0.0062
Active in nature	0.0023	0.5582	-1.1250	1.7336	0.0230

Note: The Northern European destinations also include the countries in Central and Eastern Europe. Southern Europe included countries on the northern rim of the Mediterranean Sea (except France). The variables "Shop and party", "Contacts abroad", "Escape and relax", and "Active in nature" are latent travel motive variables, with factor scores from confirmatory factor analysis. These four factors were estimated from 21 travel motives that respondents assessed the importance of, on a seven-point Likert scale.

The questionnaire and methodological approach were tested in October 2017 (N=171). This led to some adjustments of the CV questions and the so-called "bid design", the set of taxes (price increases) that respondents were asked their WTP for. The main data collection was carried out in November 2017. Of the panel members contacted, 1111 answered the questionnaire, but 223 responses with missing information on household income were removed, leaving 878 observations for analysis.

3.2 Experimental design (Willingness-to-pay scenario)

In the CV section, respondents received a scenario describing the introduction of a new hypothetical carbon tax on air travel:

"The cost for the flight you described was about NOK X for an adult [and NOK Y for your entire travel party]. Currently, all passengers pay a fixed air passenger tax of NOK 80. The tax revenues are collected by the Norwegian government and are used to fund general public activities and subventions. Suppose you are going on the same journey as the one you described, but that the airfare would be K% higher than the amount that you / your traveling party paid. Such a price increase might result from new tax adjustments introduced by the EU / EEA, in accordance with the intent of the Paris Agreement on climate change."

In a previous question, respondents had provided information on Y (airfare for entire travel party) and the size of the travel party. Based on this information, X (airfare for one adult) was calculated. The price increase K was either 15%, 45% or 75% and randomly distributed across respondents. This procedure naturally produced a relatively large vector in terms of monetary price increases (bids): 69 levels overall.

The scenario further specified (randomly) one of four different purposes for the use of the tax revenues: (i) fiscal tax, i.e., revenues are used for general governmental purposes; (ii) earmarking for rain forest conservation; (iii) earmarking for developing high-speed railways; and (iv) earmarking for developing aviation biofuel. The three earmarking alternatives are all on the political agenda in Norway and frequently discussed in the media, and, thus, well known to the public. In addition, the carbon tax was introduced as either (i) a fixed tariff, corresponding to the air passenger tax at the time; or (ii) dependent on the destination, implying higher taxes for intercontinental, as opposed to regional, flights. This resulted in a 2×4 between-subjects experimental design, where respondents were randomly assigned to one of the experimental groups (Table 2).

Table 2: Number of respondents in the experimental groups

	Fiscal tax	Earmarked for rain forest conversation	Earmarked for high-speed rail development	Earmarked for biofuel production	Total
Fixed tax	114	121	102	109	446
Dependent on destination	111	99	115	107	432

The elicitation of WTPs followed a double-bounded approach. The first bid (actual fare × K) was followed up by a second bid, e.g., 75% greater than the first if the respondent accepted the bid and 75% lower otherwise. The response format was a Likert type, comprising five alternatives along a range: "Yes, absolutely sure," "Yes, probably," "Uncertain / Don't know," "No, probably not," "No, definitely not." The respondents faced an increased second bid if they chose one of the two "yes" answers, while a "no" or a "don't know" yielded a decreased bid.

3.3 Estimation of WTP

The discrete responses to the bids can be analyzed nonparametrically and in parametric models (Kriström, 1990; Hanemann & Kanninen, 1999). Kriström (1990) proposed a nonparametric WTP formula, based on Ayer et al. (1955), applying empirical "yes" shares with additional assumptions about curve smoothing, about the shares wanting the product at zero cost, and about the choke price. If p represents the posted price, different respondents face different prices from a bid vector of size j=1,…,J-1. The price for j=0, p^0, is the zero price, and the price for j=J, p^J, is the choke price, yielding the following mean estimate represented by the area under the curve given by the "yes" shares to the different prices, j (π^j):

$$WTP_{\text{Ayer-Kriström}} = ½\Sigma_{j=0}^{J}(p^{j+1}–p^{j})(\pi^{j+1}–\pi^{j}) \quad (1)$$

Another nonparametric WTP estimate is based on the Turnbull lower bound (Turnbull 1976), which applies the "no" shares to the posted prices (1–π^j) according to the following function:

$$WTP_{\text{Turnbull}} =\Sigma_{j=1}^{J-1}p^{j}((1–\pi)^{j+1}–(1–\pi)^{j}) \quad (2)$$

Thus, the Turnbull nonparametric WTP function is a step function that assumes that the share accepting an amount between p^1 and p^2 is equal to the share accepting p^2, the share accepting an amount above the highest bid is zero, and the share accepting the product at zero cost is equal to the share accepting p^1, the lowest bid.

Parametrically, the probability of a "yes" to the posted price can be specified as a logit model:

$$\Pi^{yes}(p)=1/(\exp(–\alpha+\beta_0p)) \quad (3)$$

where β_0 is the estimated coefficient of the price, and α the estimated constant term. As $–\alpha+\beta_0p$ is a linear function, this model can be termed a linear-logistic model. A popular alternative is the log-logistic model (Bishop & Heberlein, 1979):

$$\Pi^{yes}(p)=1/(\exp(–\alpha+\ln\beta_0p)) \quad (4)$$

Mean WTP can be estimated as $-\alpha/\beta_0$, based on the linear-logistic model, and as $(\exp(–\alpha/\beta_0))(\Gamma(1–\beta_0))(\Gamma(1+\beta_0))$ based on the log-logistic model, where Γ refers to the gamma function (Hanemann & Kanninen, 1999).

3.4 WTP predictors

In the parametric models, both sociodemographic and journey characteristics are included as predictors of air travelers' WTP for carbon taxes. Latent variables based on travel motives were also tested in parametric models of "yes" answers to the carbon-tax driven flight price increase (see Table 1 above). The 21 travel motive statements comprised both "push" factors (e.g., "the need for relaxation," "escape from daily routines") and "pull" factors (e.g., "maintain contact with family," "experience nature"). The four latent travel motives, identified by exploratory factor analysis, was re-estimated by confirmatory factor analysis (see Table A1 in Appendix). In addition to WTP estimations for the whole sample, we also estimated WTP across flight destination groups and flight cost groups.

4. RESULTS

4.1 Estimated WTP (in percent) and effect of regulatory scheme in the whole sample

Figures 1–3 show the Ayer-Kriström nonparametric distribution of all “yes” answers to the first percentage increase, a single-bounded (SB) model of Bid1, as well as the Turnbull lower-bound nonparametric distribution of “yes” answers to the first (SB) and to the first and second percentage increases, a double-bounded (DB) model of Bid1 and Bid2 (Kriström, 1990).

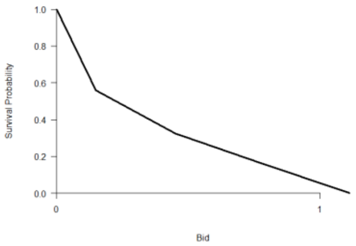

Figure 1: Ayer-Kriström SB, all “yes”

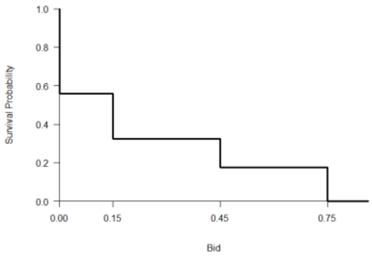

Figure 2: Turnbull SB, all “yes”

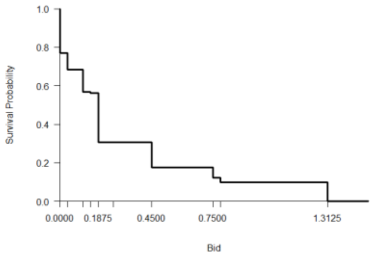

Figure 3: Turnbull DB, all “yes”

Figures 1 and 2 show clearly the monotonically decreasing share of “yes” responses with respect to increasing price change (Bid1), which is an indication of theoretically-valid stated preference data. The monotonically-decreasing pattern is also maintained in Figure 3 (Bid1+Bid2). The following table summarizes the WTP estimates from the nonparametric models in Figures 1–3, as well as from parametric models (more precisely, the linear-logistic models).

Table 3. Estimated WTP for carbon fees – percentage increase in airline ticket price – all “yes” (N=878)

Models / Parameters	Nonparametric models			Parametric models	
	Ayer-Kriström SB	Turnbull SB	Turnbull DB	Linear-logistic SB	Linear-logistic DB
Bid (scale)				-2.9762 *** (0.3208)	-3.42516 *** (0.17777)
Constant (location)				0.6560 *** (0.1476)	0.06527 (0.07474)
Median WTP	0.2243	[0.15,0.45]	[0.188,0.263]	0.2204 [0.1512,0.2738]	0.0190 [-0.0274,0.0616]
Truncated mean WTP		0.2341	0.312	0.2977 [0.2734,0.3224]	0.2085 [0.1886,0.2313]
Mean WTP	0.3563			0.3609 [0.3265,0.4082]	0.2120 [0.1912,0.2368]
Log-likelihood				-522.9	-1104.8
Bayesian information criterion (BIC)				1059.4	2223.2
Likelihood ratio statistic				95.5***	
McFadden pseudo R^2 (adjusted)				0.0802	

Note: Standard errors of coefficients in round brackets and confidence intervals of WTP estimates in squared brackets. Truncated mean indicates truncation to the maximum bid. The mean WTP from the nonparametric Ayer-Kriström model is equal to the Spearman-Karber estimate, while the (truncated) mean WTP from the nonparametric Turnbull model is equal to the Kaplan-Meier estimate. All parametric and nonparametric modeling of WTP was carried out in the DCchoice package of the statistical program R (Aizaki et al., 2014).

Consistent with the non-parametric distribution, the models in Table 3 have bid coefficients with significantly negative signs; an important result for theoretical validity of the models. Most of the estimates of WTP are in the range from just under 20% to just above 30%. While the nonparametric model of double-bounded choices tightens the median interval, compared to the single-bounded choices, the parametric DB model yields a median estimate that is far below the other estimates: around 0.

When restricting the yes-answers to only those respondents who were certain about their "yes" answer (setting uncertain "yes" answers to "no"), estimated WTP is of course substantially lower. The non-parametric distributions will be flatter, although monotonically decreasing. As also the uncertain "yes" to the first bid received a higher second bid, we do not have a complete double-bounded model for certain "yes". Table 4 summarizes the WTP estimates from nonparametric and parametric models of certain "yes" (SB).

Table 4. Estimated WTP for carbon fees – percentage increase in airline ticket price – certain "yes" (N=878)

Models / Parameters	Nonparametric models			Parametric model
	Ayer-Kriström SB	Turnbull SB	Turnbull DB	Linear-logistic SB
Bid (scale)				-2.9964*** (0.4690)
Constant (location)				-0.7093*** (0.1837)
Median WTP	0.0989	[0,0.15]	[0.0375,0.112]	-0.2367 [-0.4942,-0.0955]
Truncated mean WTP		0.0843	0.208	0.1166 [0.1005,0.1361]
Mean WTP	0.1768			0.1335 [0.1151,0.1616]
Log-likelihood				-322.9
Bayesian information criterion (BIC)				659.4
Likelihood ratio statistic				47.2***
McFadden pseudo R^2 (adjusted)				0.0623

Note: Standard errors of coefficients in round brackets and Krinsky and Robb confidence intervals of WTP estimates in squared brackets. Truncated mean indicates truncation to the maximum bid. The mean WTP from the nonparametric Ayer-Kriström model is equal to the Spearman-Karber estimate, while the (truncated) mean WTP from the nonparametric Turnbull model is equal to the Kaplan-Meier estimate. All parametric and nonparametric modeling of WTP was carried out in R applying the DCchoice package (Aizaki et al., 2014).

4.2 Attitudes and estimated WTP

After the questions about willingness to pay higher flight prices, the respondents faced direct questions about which type of ear-marking they preferred. In a similar vein, the respondents were asked about their attitudes towards taxation. Table 5 lists the statements and the shares ticking under each of these.

Table 5. Stated attitudes towards air passenger taxation and earmarking (N=878)

Which of the following statements best describes your attitude towards air passenger taxes?	
I accept fees, but the fee should be designed in such a way that everyone pays the same, regardless of the travel distance, such as the current air passenger tax.	10%
I accept fees, but the fee should be designed in such a way that those who contribute most to CO_2 emissions (long travel distances and stopovers) should pay more.	33%
I accept fees and think no particular taxation scheme is better than others.	7%
I am against fees and think no particular taxation scheme is better than others.	19%
I am against fees, but if there should be any fee, it should be designed in such a way that those who contribute most to CO_2 emissions (long travel distances and stopovers) should pay more.	16%
I am against fees, but if there should be any fee, it should be designed in such a way that everyone pays the same, regardless of the travel distance, similar to the current air passenger tax.	7%
Other / Do not know	8%
Which of the following statements best describes your attitude towards earmarking of taxes? (By earmarking is meant that the income from a tax is applied for a particular purpose.)	
Collected fees should not be earmarked but go to the Norwegian state (for general public activity, benefits, and transfers).	10%
Collected fees should be earmarked for the activity that is taxed, e.g., revenues from air passenger taxes should be applied to construction of high-speed railways in Norway and across the border.	34%
Collected fees should be earmarked to reduce the particular effect that is being taxed, e.g., revenues from air passenger taxes should be applied to increased use of Norwegian wood in aviation fuel.	18%
Collected fees should be earmarked to counteract the particular effect that is being taxed, e.g., revenues from air passenger taxes should be applied to preservation of rainforest areas in tropical countries.	14%
Collected fees should be earmarked for other purposes (please specify):	5%
Do not know.	19%

Note: The statements, under both questions, were given in random order.

Tables 6 and 7 show the WTP estimates across the various response categories.

Table 6. WTP for carbon fees across earmarking preference groups – nonparametric and parametric models (SB format, bid only) – all "yes" (N=878)

Earmarking preference		Percentages			Money amounts			
		Turnbull	Ayer-Kriström	Linear-logistic	Turnbull	Ayer-Kriström	Linear-logistic	Log-logistic
Rainforest conservation	Median WTP		0.33	0.4 [0.27,0.52]		682	1260 [787,1702]	935 [645,1355]
(*n*=122)	Truncated mean WTP	0.30	1.18	0.39 [0.32,0.45]	994	1051	1537 [1211,2150]	2317 [1586,3792]
No ear-marking - fiscal	Median WTP		0.32	0.35 [0.11,0.5]		632	805 [-414,1435]	608 [268,968]
(*n*=92)	Truncated mean WTP	0.28	0.44	0.36 [0.28,0.44]	978	1068	1402 [1011,2548]	1696 [1126,2648]
High-speed railway construction	Median WTP		0.29	0.28 [0.19,0.35]		542	537 [-132,965]	467 [284,658]
(*n*=300)	Truncated mean WTP	0.24	0.35	0.32 [0.28,0.36]	1070	1169	1387 [1084,2112]	2230 [1632,3093]
Aviation biofuel development	Median WTP		0.14	0.15 [-0.38,0.29]		176	-183 [-4132,723]	295 [22,592]
(*n*=155)	Truncated mean WTP	0.23	0.33	0.28 [0.22,0.33]	847	902	1463 [1008,2514]	2047 [1417,3115]
Other ear-marking	Median WTP		0.12	-0.1 [-4.63,2.88]		75	-2268 [-30730,43163]	18 [0,6364400000000000]
(*n*=46)	Truncated mean WTP	0.15	0.26	0.19 [0.11,0.3]	515	607	1220 [550,11122]	2660 [1008,7380]
Do not know	Median WTP		0.13	-0.09 [-1.13,0.14]		300	-835 [-6227,162]	196 [268,968]
(*n*=163)	Truncated mean WTP	0.16	0.26	0.2 [0.15,0.26]	709	769	987 [681,2029]	1237 [1126,2648]

Note: SB-based models including only the bid, as in Table 3. Krinsky and Robb confidence intervals of WTP estimates in squared brackets.

Table 7. WTP for carbon fees across carbon fee preference groups – nonparametric and parametric models (SB format, bid only) – all "yes" (N=878)

Carbon fee preference		Percentages			Money amounts			
		Turnbull	Ayer-Kriström	Linear-logistic	Turnbull	Ayer-Kriström	Linear-logistic	Log-logistic
Positive but variable tax is preferable	Median WTP		0.42	0.45 [0.38,0.52]		631	1426 [947,1945]	1002 [724,1398]
(*n*=292)	Truncated mean WTP	0.33	0.47	0.42 [0.38,0.46]	1572	1665	2117 [1685,2913]	2890 [2185,3797]
Positive notwithstanding type	Median WTP		0.40	0.41 [0.21,0.61]		500	1268 [-480,2910]	919 [226,2522]
(*n*=65)	Truncated mean WTP	0.32	0.45	0.4 [0.3,0.48]	1440	1579	2079 [1311,5783]	3231 [1882,6066]
Positive but fixed tax is preferable	Median WTP		0.18	0.16 [-0.75,0.39]		252	323 [-2702,1361]	374 [56,725]
(*n*=85)	Truncated mean WTP	0.23	0.61	0.29 [0.22,0.37]	936	1035	1523 [993,3353]	2007 [1242,3412]
Negative but variable tax is preferable	Median WTP		0.15	0.18 [-0.07,0.3]		639	520 [-289,957]	455 [211,680]
(*n*=142)	Truncated mean WTP	0.21	0.31	0.27 [0.21,0.33]	754	809	1031 [805,1512]	1752 [1172,3118]
Negative but fixed tax is preferable	Median WTP		0.19	0.18 [-0.39,0.34]		100	-796 [-11846,8534]	180 [0,582]
(*n*=58)	Truncated mean WTP	0.19	0.30	0.26 [0.17,0.35]	755	821	1132 [615,3478]	1389 [792,3020]
Negative notwithstanding type	Median WTP		0.10	-0.61 [-7.8,6.1]		125	-756 [-5140,27]	96 [8,220]
(*n*=166)	Truncated mean WTP	0.11	0.26	0.14 [0.1,0.19]	278	328	487 [333,1139]	754 [485,1331]
Do not know	Median WTP		0.14	0.09 [-0.49,0.25]		280	320 [-587,706]	340 [111,533]
(*n*=70)	Truncated mean WTP	0.13	0.27	0.2 [0.13,0.29]	419	497	574 [382,1061]	698 [443,1508]

Note: SB-based models including only the bid, as in Table 3. Krinsky and Robb confidence intervals of WTP estimates in squared brackets.

Regarding the earmarking attitude groups, those preferring earmarking of the tax for rainforest conservation had higher WTP estimates than those preferring earmarking of the tax for high-speed rail or aviation biofuel development. However, the confidence intervals were overlapping. Those preferring no earmarking of the tax had WTP estimates mostly between those of the rainforest conservation group and the other two earmarking preference groups (Table 6).

Considering the carbon fee preference, it is hardly surprising that those being positive towards fees have a higher WTP than those who are negative (Table 7). However, the difference between those positive but preferring equal tax for all and those negative but preferring variable tax was relatively minor. Only those who felt positive towards carbon taxes and preferring a variable tax with respect to flight distance had a WTP significantly higher, in terms of (mostly) non-overlapping confidence intervals, than those who felt negative towards taxes. Those preferring variable tax, whether positive or negative towards carbon fees as such, ranked higher in WTP than those preferring fixed taxes and those not having a preference for either variable or fixed; however, the confidence intervals across positive groups and across negative groups are overlapping.

4.3 Determinants of WTP

This section expands upon the parametric modeling of "yes" answers, applying percentage bids as well as money bids (NOK). We present only models for all "yes," comprising both those certain and those more uncertain about their "yes" answer. We present only models based on the SB format. Table 8 shows linear-logistic models for percentage increases and log-logistic models for monetary increases in the round-trip flight cost. The independent variables comprise socioeconomic/demographic characteristics plus either the dummy variables for the type of earmarking (versus fiscal fee) and variable fee (versus fixed fee) or the latent travel-motive variables.

Table 8. Explaining WTP for carbon fees – socioeconomic/demographic characteristics and type of carbon fee / latent travel-motive variables – percentage increase and money increase in airline ticket price – all "yes" (N=878)

Models / Parameters	Linear-logistic SB (%)		Linear-logistic SB (NOK)		Log-logistic SB (NOK)	
Bid (scale)	-3.14 *** (0.33)	-3.16 *** (0.33)	-0.0007 *** (0.0001)	-0.0007 *** (0.0001)	-0.92 *** (0.10)	-0.92 *** (0.10)
Flight cost (travel party, NOK)	-0.00003 ** (0.00001)	-0.00003 ** (0.00001)	0.00001 (0.00001)	0.00001 (0.00001)	0.18 (0.11)	0.21 . (0.11)
Household income (gross annual, in 1000 NOK)	0.0004 * (0.0002)	0.0005 * (0.0002)	0.0004 * (0.0002)	0.0004 * (0.0002)	0.31 . (0.16)	0.34 * (0.16)
Age	-0.04 (0.03)	-0.03 (0.03)	-0.03 (0.03)	-0.02 (0.03)	0.71 ** (0.22)	0.54 * (0.24)
Age squared	0.0006 . (0.0003)	0.0004 (0.0003)	0.0005 . (0.0003)	0.0004 (0.0003)		
Household size	-0.04 (0.08)	-0.04 (0.08)	-0.04 (0.07)	-0.03 (0.07)	-0.36 (0.28)	-0.32 (0.28)
Female gender	0.02 (0.16)	0.06 (0.16)	0.06 (0.16)	0.10 (0.16)	0.06 (0.16)	0.11 (0.16)
University degree	-0.05 (0.17)	-0.13 (0.17)	-0.02 (0.17)	-0.09 (0.17)	-0.03 (0.17)	-0.11 (0.17)
Destination in Southern Europe	-0.29 (0.27)	-0.32 (0.28)	0.32 (0.28)	0.28 (0.29)	0.14 (0.28)	0.08 (0.28)
Destination outside Europe	-0.29 . (0.17)	-0.14 (0.20)	-0.09 (0.17)	0.01 (0.19)	-0.07 (0.17)	0.03 (0.20)
Earmarked fee to biofuel production	0.00 (0.22)		-0.01 (0.22)		-0.05 (0.22)	
Earmarked fee to rainforest conservation	0.18 (0.22)		0.20 (0.22)		0.19 (0.22)	
Earmarked fee to high-speed rail development	-0.02 (0.22)		0.02 (0.22)		0.01 (0.22)	
Variable fee with respect to flight length	0.14 (0.15)		0.13 (0.15)		0.13 (0.15)	
Shop & entertainment motive		-0.004 (0.15)		-0.01 (0.15)		-0.03 (0.15)
Other home motive		-7.63 (0.14)		-6.64 (0.13)		-0.07 (0.14)
Relaxation motive		-0.43 * (0.17)		-3.53 * (0.17)		-0.44 ** (0.17)
Active in nature motive		0.29 . (0.17)		0.30 . (0.17)		0.37 * (0.16)
Constant (location)	1.27 . (0.72)	1,14 (0.71)	0.06 (0.69)	-3.01 (0.69)	-2.48 (2.08)	-2.47 (2.11)
Median WTP	0.22 [0.16,0.28]	0.22 [0.15,0.28]	501 [157,716]	487 [145,704]	487 [377,584]	483 [388,585]
Truncated mean WTP	0.30 [0.27,0.32]	0.29 [0.27,0.32]	1253 [1100,1476]	1252 [1098,1473]	2016 [1617,2579]	2000 [1606,2624]
Mean WTP	0.35 [0.32,0.4]	0.35 [0.32,0.39]	1253 [1100,1476]	1252 [1098,1473]		0
Log-likelihood	-505.1	-501.8	-508.7	-506.5	-507.2	-503.0
Bayesian information criterion (BIC)	1111.9	1105.2	1119.1	1114.7	1109.4	1101.0
Likelihood ratio statistic	131.1***	137.81***	123.8***	128.3***	126.84***	135.27***
McFadden pseudo R^2 (adjusted)	0.0886	0.0945	0.0823	0.0862	0.0866	0.0940

Note: Standard errors of coefficients in round brackets and Krinsky and Robb confidence intervals of WTP estimates in squared brackets. Truncated mean indicates truncation to the maximum bid.

*** <.001, ** <.01, * <.05, . <.1

In the linear-logistic models, the income variable obtained a significantly positive coefficient sign, while in the log-logistic model, it is only significantly positive at the 10 percent level. The coefficient of log of age obtains a significantly positive sign, in the log-logistic model; while the coefficient of age is not significantly different from zero in the linear-logistic models. The last trip's flight cost for the respondents' travel party obtained a significantly negative coefficient in the linear-logistic model for percentage increases.

The coefficients of the earmarking dummy variables were not significantly different from zero, nor was the variable for the variable fee dummy coefficient significantly different from zero.[2] Two of the latent travel motive variables showed a relationship with respondents' willingness to pay increased carbon fees. There was a negative relationship between WTP and the escape-relaxation motive, while there was a weak positive relationship between WTP and the nature-active motive (Table 8).

4.4 WTP across flight segments

Our dataset of international flight travelers is heterogenous in various aspects. In this section we focus primarily on whether the preference for regulatory schemes varies across flight-cost and destination groups. Table 9 below compares three flight cost groups of about equal size.

Table 9. WTP for carbon fees across three flight cost groups – all "yes" (N=878)

	Flight cost level 1 (500–4500 NOK) (*n*=297)			Flight cost level 2 (4600–9600 NOK) (*n*=287)			Flight cost level 3 (10,000–72,000 NOK) (*n*=294)		
	Linear-logistic SB (%)	Linear-logistic SB (NOK)	Log-logistic SB (NOK)	Linear-logistic SB (%)	Linear-logistic SB (NOK)	Log-logistic SB (NOK)	Linear-logistic SB (%)	Linear-logistic SB (NOK)	Log-logistic SB (NOK)
Bid (scale)	-2.680 *** (0.55)	-0.001 *** (0.0002)	-0.79 *** (0.16)	-3.060 *** (0.57)	-0.001 *** (0.0002)	-0.91 *** (0.18)	-4.349 *** (0.69)	-0.001 *** (0.0001)	-1.25 *** (0.20)
Household income (gross annual, in 1000 NOK)	0.0003 (0.0003)	0.0005 (0.0003)	0.26 (0.25)	0.0004 (0.0003)	0.0002 (0.0003)	0.16 (0.27)	0.0007 (0.0005)	0.0005 (0.0004)	0.55 (0.38)
Age	-0.12 * (0.05)	-0.13 * (0.05)	0.62 (0.34)	-0.002 (0.05)	0.022 (0.05)	0.90 * (0.39)	0.007 (0.07)	0.022 (0.06)	1.04 * (0.50)
Age squared	0.0014 ** (0.0005)	0.0015 ** (0.0005)		0.0002 (0.0005)	-1.51700 (0.0005)		0.0001 (0.0007)	0.00003 (0.0006)	
Household size	-0.21 . (0.12)	-0.22 . (0.12)	-1.05 * (0.44)	0.09 (0.14)	0.02 (0.14)	0.14 (0.50)	0.14 (0.16)	0.14 (0.16)	0.30 (0.58)
Female gender	-0.03 (0.26)	0.07 (0.26)	0.05 (0.26)	-0.08 (0.28)	-5.99 (0.27)	-0.06 (0.27)	0.05 (0.30)	0.19 (0.29)	0.15 (0.30)
University degree	-0.44 (0.29)	-0.45 (0.29)	-0.55 . (0.28)	-0.02 (0.29)	0.003 (0.29)	0.02 (0.29)	0.48 (0.34)	0.50 (0.33)	0.53 (0.34)
Earmarked fee to biofuel production	0.59 (0.37)	0.66 . (0.37)	0.49 (0.36)	-0.02 (0.38)	-0.12 (0.38)	-0.08 (0.38)	-0.73 . (0.43)	-0.69 (0.42)	-0.84 . (0.44)
Earmarked fee to rainforest conservation	0.46 (0.38)	0.49 (0.38)	0.40 (0.37)	0.21 (0.37)	0.11 (0.37)	0.15 (0.37)	0.23 (0.41)	0.08 (0.39)	0.09 (0.40)
Earmarked fee to high-speed rail development	0.42 (0.38)	0.39 (0.37)	0.31 (0.37)	-0.01 (0.38)	-6.60 (0.38)	-0.05 (0.38)	-0.31 (0.41)	-1.17 (0.40)	-0.24 (0.41)
Variable fee with respect to flight length	-0.28 (0.26)	-0.24 (0.26)	-0.22 (0.26)	0.16 (0.27)	0.14 (0.27)	0.13 (0.27)	0.58 . (0.32)	0.46 (0.30)	0.50 (0.31)
Constant (location)	3.23 ** (1.14)	2.66 * (1.10)	0.08 (3.14)	-0.33 (1.29)	-7.53 (1.28)	-0.04 (3.60)	-1.38 (1.60)	-2.26 (1.51)	-4.08 (5.23)
Median WTP	0.29 [0.16,0.38]	366 [43,597]	316 [195,428]	0.25 [0.1,0.34]	679 [190,969]	564 [340,761]	0.17 [0.05,0.24]	393 [586,1000]	719 [488,930]
Truncated mean WTP	0.33 [0.29,0.38]	787 [637,998]	856 [697,1040]	0.31 [0.27,0.36]	1174 [990,1507]	1520 [1229,1904]	0.24 [0.2,0.28]	1431 [1159,1910]	1805 [1399,2496]
Mean WTP	0.43 [0.36,0.56]	838 [655,1295]		0.37 [0.32,0.47]	1181 [993,1589]		0.26 [0.22,0.31]	1431 [1159,1910]	
Log-likelihood	-178.2	-178.9	-180.7	-169.1	-169.1	-170.8	-142.3	-145.4	-140.9
Bayesian information criterion (BIC)	24.9	26.3	24.0	06.1	06.3	03.8	52.9	59.0	44.3
Likelihood ratio statistic	45.62	44.2	40.80	40.8	40.7	37.46	63.26	57.1	66.18
McFadden pseudo R^2 (adjusted)	0.0538	0.0503	0.0468	0.0445	0.0441	0.0408	0.1128	0.0953	0.1269

Note: Standard errors of coefficients in round brackets and Krinsky and Robb confidence intervals of WTP estimates in squared brackets. Truncated mean indicates truncation to the maximum bid.

*** <.001, ** <.01, * <.05, . <.1

[2] We also tested for cross factors effects, that each ear-marking type plus fiscal type all occur (randomly) in combination with both distance-variable tax and fixed tax. No coefficient of these interactions was significantly different from zero, neither in the models based on percentage increases nor in the models based on money increases.

There was a contrast of regulatory scheme preferences between the highest and lowest flight cost groups, albeit somewhat weak statistically. In the group reporting the highest flight costs, WTP was higher when the new carbon fee was specified as varying with respect to travel length. In the same group, WTP was lower when the new carbon fee was specified as earmarked for the development of aviation biofuel (generated from national wood resources), while the opposite was the case in the group reporting the lowest flight costs. There was a pattern of higher percentage WTP for those reporting lower flight cost and higher monetary WTP for those reporting higher flight cost; in terms of truncated mean WTP; the confidence intervals for the two groups reporting lowest and highest flight costs did not overlap (Table 9).[3]

The flight cost (low, medium, high) was of course correlated with the destination (Northern/Central Europe, Southern Europe, intercontinental), with a Pearson coefficient of about 0.4. There were relatively more of the lowest flight cost group among those reporting Northern/Central European destinations and relatively more of the highest flight cost group among those reporting intercontinental destinations. The average flight costs (for the travel party) in the three destination groups were 5840 NOK for Northern/Central Europe, 10,185 NOK for Southern Europe, and 17,455 NOK for intercontinental. Regarding difference in regulatory scheme preferences between destination groups, there was only one statistically significant difference: in the group having traveled to Southern European destinations, WTP was higher when the new carbon fee was specified as variable.

5. Implications for tourism management

Tourism has external effects, both positive and negative. The CO_2 emissions resulting from air travel is among the negative effects. A compulsory carbon tax represents a way of internalizing the negative effect in individual travelers' decision making by confronting him/her with the cost of the negative externalities of flying. Voluntary carbon offsets enable free-riding, which might explain both a lack of support and lower payments compared to mandatory carbon taxes (Sonnenschein and Mundaca, 2019; Schwirplies and Ziegler, 2016). Moreover, in our sample a much larger share stated support for a tax that varied according to emissions, even among those not favoring taxes in general (Table 5).

A mandatory tax set according to the individual travelers' CO_2 emission costs could form an element of the more comprehensive framework of carbon risk management for destinations presented by Becken and Shuker (2019). Gössling et al. (2015) proposed an alternative to the price mechanism, "the use of use of marketing practices to attract some markets and market segments and demarket others" (p. 210). Demarketing refers to efforts aimed to decrease demand in general or from specific segments. However, if one goal of such marketing for a destination is to receive a larger share of visitors from more nearby markets, a variable tax with respect to emissions will work in the same direction.

Economic theory is quite clear regarding the primary effect of a tax: It has a decreasing effect on demand. Taxation can thus serve as a tool of confining demand to more sustainable levels. Mandatory taxes as regulatory mechanism is also relevant for destinations that risk degradation from excessive visitor numbers, or "overtourism" (UNWTO, 2017). Whether or not the taxation is earmarked to a specific cause, the tax payments from travelers or visitors yield funds that at least partially can be spent on mitigating efforts.

[3] Nonparametric models (Ayer-Kriström and Turnbull) show exactly the same WTP pattern across flight cost groups as the parametric logit models.

6. Conclusions

This study has investigated Norwegian leisure air travelers' willingness to pay increased mandatory carbon fees, applying the contingent valuation (CV) method. This analytic approach is particularly applicable to hypothetical policy scenarios with coercive payment mechanisms, yielding estimates of economic preference and future behavior that, overall, are more realistic than those derived through models based on voluntary payment mechanisms (Carson & Groves, 2007; Johnston et al., 2017). The present study also included self-assessed certainty of the acceptance of paying the proposed price increase, yielding a downward adjustment of estimated WTP (Whitehead et al., 2016).

There are three main takeaways from our case study. First, results indicate that Norwegian outbound tourists may be ready to accept higher carbon taxes than what is currently included in the airfare. The CV scenario indicated a price increase relative to the current prices; thus, a price increase beyond the existing carbon tax of 80 NOK (about $9). The mean WTP estimates based on certain "yes" yielded a range of WTP, as a percentage of last flight's price, (about 10–20%); based on all "yes" answers, the range was about 20-35%. The former estimates are comparable to the estimated willingness to pay air passenger duty taxes in the UK (Seetaram et al., 2018) and the mandatory air ticket carbon tax in Sweden (Sonnensschein & Smedby, 2018); while the estimates based on all "yes" answers were substantially higher. The median WTP estimates, i.e., the carbon tax increase that half of the study participants was willing to accept, ranged from 0 to 10% (0–100 NOK) based on certain "yes" answers to about 20% (400–600 NOK), based on all "yes" answers.[4]

Second, the willingness-to-pay carbon taxes, or acceptance of a specific price increase, was not significantly related to the taxation scheme, when considering the whole sample. This might suggest that the "issue linkage," i.e., the assumption that public acceptance of environmental taxes is higher when there is a strong link between the taxed activity and the spending cause, is less relevant in the context of leisure air travel. This would contradict much of the previous research on environmental taxation, including somewhat contradictory evidence on mandatory carbon taxes on air travel. A possible explanation for the opposing result lies in the different methodological approaches applied. The present study built on a "between-subjects-design" wherein respondents were randomly assigned to one of eight different taxation scenarios, specifying either a fixed or a variable tax and specifying whether it was a fiscal tax or a tax that would be earmarked to one of three environmental projects (see Section 3.2). In contrast, Seetaram et al. (2018) and Sonnenschein and Smedby (2018), who both found that air passengers were in favor of earmarking tax revenues, did not specify the environmental projects for which the revenues were to be used. In our view, it is more relevant to link the revenue spending to specific environmental measures that are on the political agenda. In this way, our results reflect the fact that people have divergent opinions about major environmental projects and their funding. For instance, Norway is one of the main economic contributors to the Rainforest Foundation, but governmental involvement in rainforest conversation has been subject to debate (Riksrevisjonen, 2018), which our results seem to echo.

However, when splitting our sample with respect to travel party-flight cost levels, there was found to be an apparent taxation-scheme effect on WTP. In the subsample reporting the highest flight costs, the variable fee was positively related to WTP and earmarking for aviation-biofuel development was

[4] Our bid vector was designed as percentage increases with respect to the reported flight price of the last international travel. International flight prices vary considerably, thus it was assumed that pivoting the bid to a reference flight trip could provide more relevant bids. In retrospect, such pivoting was possibly perceived as somewhat more relevant for the half of the sample facing a distance-varying carbon fee. Facing higher percentage bids correlated weakly with expressing less belief in the implementation of increased carbon taxing (after answering the CV questions). When splitting the sample between those facing fixed and those facing variable fees, in the CV scenario, the correlation between disbelief and percentage increase in flight price was only apparent in the group facing fixed fee.

negatively related. In the subsample reporting the lowest flight costs, earmarking to aviation biofuel development was positively related to WTP.

Moreover, we did ask post-choice questions about earmarking versus fiscal fees and variable versus fixed fees, similar to the approach used by Sonnenschein and Smedby (2018). When comparing WTP across the groups of various carbon-fee and earmarking attitudes, most WTP differences were not statistically significant. Simple crosstabulations indicated a mix of attitudes that might pull WTP both up and down within the different attitudinal groups. For example, among those preferring no earmarking of carbon taxes, there was an overrepresentation of those expressing positive attitudes towards taxes and preferring equal taxes for all, as well as for those expressing negative attitudes towards taxes (notwithstanding the type). Thus, our findings indicated stronger drivers for the willingness to pay (increased) carbon tax via flight tickets than earmarking versus no earmarking and, as well, variable versus fixed. However, we do not rule out that self-selection to taxation scheme scenario, such that those preferring rainforest earmarking would only be asked their willingness to support increased carbon tax earmarked to rainforest projects, etc., could have resulted in statistically significant variation in willingness-to-pay across taxation schemes.

Finally, the results showed some impact of individual and contextual factors on WTP. In most models, household income showed a significant and positive covariation with WTP. This result also strengthens the theoretical validity of our results. Further, the log of age obtained a significantly positive coefficient in the log-logistic models. These results partly condition and partly contrast former findings (Lu & Shon 2012; Seeteram et al. 2018; Segerstedt and Grote 2016). Previous studies have reported that women are more environmental-supportive than men (MacKerron et al., 2009; Mehmetoglu, 2010). However, results above show no significant covariation between gender and stated WTP. The only gender effect observed was that female respondents attached a relatively higher importance to the last flight. Neither is education level found to be significantly related to WTP. Respondents with a university degree indicated stronger environmental concerns, but these attitudes did not transfer into a higher WTP for mandatory carbon taxes on air travel. In this respect, results support the findings of Seetaram et al. (2018). Destination was used as a proxy for flight distance, but contrary to Seetaram et al. (2018) and Sonnensschein and Smedby (2018), results do not indicate a distance effect. On the other hand, the latent travel motive variables showed varying covariation with WTP. The “push” factor “escape-relaxation” obtained a significantly negative coefficient in some models, while the “pull” factor “active in nature” obtained a significantly positive coefficient in some models. Thus, our results provide some support for a link between travel motivations and willingness to pay carbon taxes, as suggested in other studies (e.g., do Valle et al. 2012; McLennan et al. 2014).

Summing up, our results are consistent with a notion that willingness to pay increased fees for a product primarily reflects WTP for the product itself. The design of the fee as such may have a very limited impact on WTP, although there can be offsetting effects from segments with opposite fee design preferences. We find that the results of our stated preference study pass the basic theoretical validity tests of price sensitivity and covariation with wealth. Applying estimates from certain “yes” and all “yes” answers as lower and upper bounds of “true” WTP estimates will yield quite large intervals regarding the samples’ mean willingness to pay percentage increase (10–35%) and mean willingness to pay money increase (35–250 USD) in carbon fees. There is also uncertainty regarding median WTP, as the certain “yes” indicated that half the study participants may not be willing to pay increased fees. Nevertheless, our results do indicate that the “average” outbound Norwegian tourist is positively-inclined toward a carbon tax on air travel—and at a level beyond what was the current tax. Taken together, the present case study and other recent research on mandatory carbon taxation in aviation cited above indicate that there exists a scope for policymakers to implement tougher taxation regimes on air travel than seen today, in Norway and elsewhere. Compulsory carbon tax schemes work independently of air travelers’ degree of environmental friendliness; support from the electorate is more decisive for the implementation of the taxation scheme.

The decreasing effect on demand of the new Norwegian taxation regime, 75 NOK for most European destinations and 200 NOK for intercontinental flights, is probably very low, being far from yielding an overall decrease in demand for international leisure flights in Norway. Whether an increase to a level five to ten times the level of the current tax would curb demand, or an increase combined with a change to varying taxation with respect to flight length would so discourage travel, are questions left for future analyses. Further, a limitation of this study is that it deals with leisure travelers. Although the majority of air passengers travel for leisure purposes, future studies could investigate business travelers who generally are less price sensitive than leisure travelers.

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Appendix

The fit indices of the latent travel-motive variables

The results of a confirmatory factor analysis of the travel motive variables, seven-point Likert scale items, are shown in the following table.

Table A1. Fit indices for latent travel-motive variables (n=878)

Latent variable	Items (motive statements)	CFI	TLI	RMSEA	SRMR	p value (Chi sq.)
Shop and party	shopping, entertainment, fun and partying, participating in events, experiencing comfort	0.995	0.984	0.052	0.027	0.035
Contacts abroad	visiting lieu of origin, confirming own identity, carrying out errands, maintaining contacts, mastering language and culture	0.989	0.978	0.078	0.049	0.000
Escape and relax	getting away, relaxing, experiencing comfort, warmth and sun, gourmet, spa	0.984	0.974	0.087	0.055	0.000
Active in nature	being physically active, nature experiences, impetuous experiences, warmth and sun, learning something new	0.954	0.908	0.120	0.074	0.000

Note: The confirmatory factor analysis was carried out in R applying the lavaan package (Rossel, 2019).