Mireia Guix, Claudia Ollé, Xavier Font (2022) Trustworthy or misleading communication of voluntary carbon offsets in the aviation industry Tourism Management Volume 88, February 2022, 104430. Pre-publication version

Abstract

We assess the communications of 37 airlines on their own websites regarding voluntary carbon offsets (VCO) to determine the extent to which they are either trustworthy or misleading. We propose an innovative coding framework that captures the trustworthy or misleading attributes of the messages as they are applied to: i) the type of claim (product, process, fact or image), and ii) the nature of the claim (fibbing, hidden trade-off, no proof, vagueness, irrelevance, lesser of two evils or worshipping false labels). We deploy a quantitative, multi-method approach that combines content analysis and discrete choice modelling, and we corroborate the taxonomy developed with lexical analysis. We identify the various factors that affect the pattern of 56% of claims being trustworthy and 44% being misleading. We demonstrate how a combined study of the trustworthy or misleading characteristics of communications provides more learning opportunities than studying either individually.

Keywords: carbon offset, airlines, climate change, greenwashing, corporate social responsibility, green marketing.

Highlights

- More is known about misleading than trustworthy environmental communications
- Text length, timing of adoption and country of origin affect VCO trustworthiness
- Third party VCO certification does not affect the quality of the communication
- Providing VCO information before a flight purchase increases trustworthiness
- Researching trustworthy and misleading communications together improves the depth of analysis

Introduction

Aviation has witnessed sustained multi-decade growth, contributing 3.5% of the carbon footprint in 2018 (Lee et al., 2021). While COVID-19 has slowed down the growth in aviation (Le Quéré et al., 2020) and traffic is forecasted to recover at a lower rate than pre-pandemic projections (IATA, 2020), recovery will likely remain dependent upon the combustion of fossil fuel (Lee et al., 2021). Since 1960, air traffic volume has increased more rapidly than emissions (Airlines for America, 2018) thanks to efficiency gains (Lee et al., 2021). Nonetheless, technical and operational measures, and an increased switch to aviation biofuels, alone, are insufficient to achieve carbon-neutral growth (Scheelhaase et al., 2018). Market-based measures, such as offsetting schemes, are needed for a comprehensive approach to addressing aviation's carbon footprint (IATA 2020)**.** Voluntary Carbon Offsetting (VCO) passes on the responsibility of reducing the carbon footprint of travel to consumers by asking them to make a monetary contribution, which is then invested in environmental projects that reduce or sequester greenhouse gas emissions (Burns and Cowlishaw 2014; Babakhani, Ritchie, and Dolnicar 2017). Yet, the VCO market is still in an embryonic stage, with only 10% of air passengers purchasing VCO credits (Ritchie, Kemperman and Dolnicar, 2021).

Academics mainly speak of VCO as a form of greenwashing (Polonsky and Garma 2008; Polonsky, Grau, and Garma 2010) and report that airlines' poor communication and low transparency on carbon leads to low awareness and credibility amongst customers (Mair 2011; Babakhani et al. 2017; Zhang, Ritchie, Mair and Driml 2019a). More appealing and tailored VCO messages could enhance its uptake (Becken and Mackey 2017) and

contribute towards moving travellers' pro-environmental attitudes into actual behaviours (Burns and Cowlishaw 2014). Efforts have focused on improving carbon offsetting communication, identifying the framing that affects consumers' responses, attitudes and engagement with VCO (e.g. Zhang et al. 2018; Zhang et al., 2019a; Richie et al., 2021). Thus far, research has focused on the demand side of carbon offsetting, with limited attention on the supply side, despite the fact that the content of messages is important to the success of any offsetting scheme (Babakhani et al., 2017).

Given the increasing public concern over deceptive tactics regarding environmental information on websites across industries, this research studies VCO from an environmental communication perspective and studies the ability of VCO messages to convey information that allows customers to recognise what carbon offsetting is and how it works. We develop an environmental communication coding framework that considers the trustworthy or misleading claims within messages about the nature and type of carbon offsetting being offered. An assessment of the quantity and quality of VCO communication provides a more nuanced perspective of how trustworthy and misleading characteristics can be found in the same messages.

Literature Review

The airline industry is a major contributor of global warming and it is decarbonising more slowly than other sectors (Peeters et al. 2019). Previous studies have underplayed the sector's carbon emissions (Lenzen et al. 2018) and the impact of its growth (ICCT 2019). A lack of strict laws to mitigate greenhouse gas emissions presents major challenges to decarbonise the industry (Gössling et al. 2015). Whilst we are aware of the need to fly less

(Gössling et al. 2019; Cohen and Kantenbacher 2020), it is not within the general interest of the industry to do so and it is improbable from a consumer perspective (Becken and Mackey 2017), once the sector recovers post covid-19 (Amankwah-Amoah 2020). Technological improvements alongside carbon taxes and carbon trading systems are currently the focus of the aviation industry (IATA 2020). However, low-carbon aviation technologies are only nascent (Hall, Pavlenko, and Lutsey 2018). Carbon trading schemes and carbon taxes to reduce future emissions are insufficient to drive the deep, sustained reductions needed to reach net-zero emissions (Leamon et al. 2019).

Voluntary Carbon Offsetting (VCO) provides a complementary approach to limit aviation's carbon footprint. VCO is defined as "a way for individuals or organisations, in this case airline passengers and corporate customers, to neutralise their proportion of an aircraft's carbon emissions on a particular journey by investing in carbon reduction projects" (IATA 2020, 1). Effective VCO must prevent leakage (where a project that reduces emissions in one location simply increases emissions elsewhere), be permanent, be independently verified and registered, must avoid double counting (Scott et al. 2016), and ensure that real and additional emission reductions are taking place within a specific project (Gössling et al. 2007; Becken 2019). Well-managed VCO can mitigate greenhouse gas emissions, increase pressure on policy makers to implement more efficient environmental measures and can help channel investment to innovative and well-regulated projects.

However, current VCO efforts have not been shown to have an impact in the marketplace because the different carbon offset projects and providers have had inconsistent approaches to the measurement and reporting of emissions, and to the prices

96 charged (Liu et al. 2015; Ritchie et al. 2020). Moreover, VCO communication by airlines has
97 been found to lack: i) information (Gössling et al. 2009; Higham et al. 2016), ii) credibility
98 and transparency (Gössling et al. 2007; Babakhani et al. 2017), and iii) adequate disclosure,
99 clarity and scientific accuracy (Segerstedt and Grote 2016; Becken and Mackey 2017).

100 Greenwashing is the process of deliberately misleading stakeholders about the
101 importance and effectiveness of actions taken by an organisation to address their
102 environmental responsibility, to positively affect a company's image (Mayer, Ryley, and
103 Gillingwater 2015). VCO has been identified as a marketing problem when it is used as a
104 promotional tool (Polonsky et al. 2010), with Easyjet and Virgin Atlantic being accused of
105 greenwashing (Mayer et al. 2015). Customers' perceived greenwashing on environmental
106 advertising affects their attitudes towards brands, with customers identifying or
107 nonidentifying misleading information upon the types of greenwashing (Schmuck et al.,
108 2018). However, no framework has been developed to analyse VCO environmental claims
109 as either trustworthy or misleading. We adapt the work of Carlson et al. (1993), who
110 developed a matrix to recognise problem areas in environmental advertising. We
111 contribute to the literature by showing that the same claims can be both trustworthy and
112 misleading for different reasons, by combining two typologies of *type* and *nature* of claim
113 (Figure 1).

114 Figure 1. Type and nature of claim coding framework.

	TYPE OF CLAIM			
NATURE OF CLAIM	Product	Process	Fact	Image
Fibbing				
Hidden trade-off				
No-proof				
Vagueness				
Irrelevance				
Lesser of two evils				
Worshipping false labels				

Source: Claim type adapted from Carlson et al. (1993) and nature of claim from the seven sins of greenwashing (UL LLC 2020).

The X-axis of Carlson et al.'s (1993) matrix categorises environmental claims depending on the type of claim as product, process, image, and environmental fact. *Product* claims elaborate on the ecological attribute of a product (Carlson et al. 1993). Whilst the core attributes and values of eco-friendly products differ from 'normal' products (e.g. organic food), carbon offsets remain the same and are usually marketed, for a fee, as an alternative to the original product (Liu et al. 2015). Thus, VCO product claims relate to the environmental attributes of carbon offsetting or the characteristics of the airlines' offsetting program. *Process* claims refer to the ecologically high performance of a production process technique (Carlson et al. 1993), which relate to the operational process of the carbon offsetting programme or the process of carbon offsetting itself. For instance, the process involves the methodologies used to calculate carbon offsets, the third-party certification and standard-setting (Gillenwater et al. 2007), plus information on how carbon offset projects are set up, managed and offered (Lovell 2010).

Image claims enhance the organisation's green image (Carlson et al. 1993), such as associating themselves with an environmental cause with elevated public support. Claims about offset projects or the use of third-party certifications aim to increase an airline's credibility and reputation (Becken and Mackey 2017). Thus, airlines may use image claims to attract tourists concerned with their emissions by promoting and positioning the airline as an eco-friendly business (Zeppel and Beaumont 2013). *Fact* claims refer to the inclusion of an independent statement that is factual in nature regarding the environment (Carlson et al. 1993) such as genuine claims related to the topic of flying or carbon offsetting.

The y-axis of Carlson et al.'s (1993) matrix categorises the nature of misleading claims. We updated the initial items with the TerraChoice taxonomy to categorise "seven sins" of greenwashing (UL LLC 2020) and mapped it against the VCO literature. *Fibbing* identifies claims that are simply false, such as claims that misrepresent the scientific realities of flying or offsetting (e.g., Segerstedt and Grote 2016). *Hidden trade-off* is seen in claims that suggest carbon offsetting is green, based upon a narrow set of attributes without attention to other important environmental issues, such as claims that depict carbon offsetting projects in a positive light without considering their negative aspects (Polonsky et al. 2010; Kim et al. 2016; Becken and Mackey 2017). *No-proof* occurs when an environmental claim is not substantiated by easily accessible supporting information or by a reliable third-party certification of the offsetting programme (Burns and Cowlishaw 2014; Becken and Mackey 2017; Zhang et al. 2019b).

A claim is *vague* when it is so poorly defined or broad that consumers are likely to misunderstand its real meaning, such as claims that do not provide enough detail to understand the VCO or that use jargon terminologies without clarification of their meanings (Gössling et al. 2009; Kim et al. 2016; Liu, Wang, and Su 2016). A claim is *irrelevant* when it may be truthful but is unhelpful for consumers seeking environmentally preferable products, such as claims that provide additional, non-related information (Gössling et al. 2009; Becken and Mackey 2017). The *lesser of two evils* refers to a claim that may be true but that risks distracting the consumer from the greater environmental impacts of the category as a whole, as claims that do not regard other alternatives apart from VCO (Gössling et al. 2007; Smith 2007; Burns and Cowlishaw 2014). Finally, *worshipping false labels* refers to a claim that gives the impression of third-party endorsement where no such endorsement exists; this can be seen in claims that use false

certifications or refer to an untrustworthy third-party, standard or body (Babakhani et al. 2017; Becken and Mackey 2017).

Methodology

This study adopted a quantitative multi-method approach that combined quantitative content analysis and multinomial logit regressions to assess the quality of airline communications on carbon offsetting programmes. First, we focussed on providing empirical evidence of the extent and nature of airlines' offsetting practices by updating Becken and Mackey's (2017) baseline with airlines that were operating in 2020. This resulted in 116 airlines that were operating in both 2016 and 2020, of which 37 provided VCO information on their website. We applied Becken and Mackey's (2017) coding scheme to extract relevant information from the airline's websites and identify VCO practices.

Second, the study sought to determine the extent and nature of VCO communication. Manual content analysis, widely used in social and environmental responsibility research (Jose and Lee 2007), is a suitable approach to analyse VCO communication by "making inferences by objectively and systematically identifying specified characteristics of messages" (Holsti 1969, 14). We undertook a quantitative content analysis of the 37 airlines providing an offsetting option, either on their websites or in an external website owned by the same airline (Table 1). Information on an external partner's website was excluded. Each airline's corpus was downloaded, saved as a pdf and the information was extracted into a spreadsheet.

Table 1: List of airlines with offsetting option grouped by the amount of VCO text offered on their websites

Airlines	Nº of trustworthy claims	Nº of misleading claims	Total nº of sentences
Websites with a large amount of VCO text			
Air New Zealand	155	55	210
Easyjet	62	52	106
Cathay Pacific	57	31	84
Qantas Airlines	41	42	77
China Airlines	48	34	76
SAS Airlines	28	43	68
TAP Air Portugal	52	17	68
Norwegian	45	22	61
Kenya Airways	33	16	46
Iceland Air	34	16	45
Air France	32	23	44
Delta Airlines	21	31	43
Jet Blue	19	29	43
Total percentage	60%	40%	960
Websites with an average amount of VCO text			
Jet Star	16	30	42
KLM	26	18	42
Ryanair	13	29	41
United Airlines	27	11	36
Aeromexico	23	14	35
Virgin Australia	23	12	34
Thai Airways	26	7	31
British Airways	15	15	30
Srilankan Airlines	20	13	30
Eva Air	10	23	28
SunExpress	15	13	28
Virgin Atlantic	14	15	27
Total percentage	53%	47%	404
Websites with a small amount of VCO text			
Lufthansa	11	16	25
Harbour Air	13	16	24
Austrian Airlines	9	14	21
Eurowings	11	12	20
South African Airways	11	9	16
Volaris	6	7	12
Alaska Airlines	4	11	11
Ana ALL Nippon	3	5	7
Air Canada	2	6	6
Swiss Airlines	26	7	6
Japan Airlines	2	3	4

	WestJet	3	2	4
	Total percentage	48%	52%	156

Source: Author's own elaboration from the content analysis of the airlines' website (July 2020).

A methodological contribution of this article was the development of a coding scheme for VCO greenwashing (Tables 2 and 3 for the nature and type of claims respectively). We classified claims as being either *trustworthy* communication when they disclose correct scientific information, provide detailed and relevant information, do not hide the negative attributes of carbon offsetting or carbon offsetting projects, provide proof, evidence or certifications, and do not distract customers from greater environmental impacts, or *misleading* when they do the opposite. A category of neutral communication was not included since sentences could only engage in trustworthy or misleading communication. A score of either +1 (trustworthy communication) or -1 (misleading communication) was given to every claim within each sentence, for each type and nature of communication, resulting in more claims than sentences.

Table 2. The coding scheme used to assess VCO communications by the nature of their claims.

Nature of claim	Trustworthy communication (+1)	Misleading communication (-1)
Fibbing	Claims accurately representing the scientific realities of flying or offsetting (e.g. offsetting counterbalances the amount of emissions).	Claims misrepresenting the scientific realities of flying or offsetting (e.g. offsetting reduces emissions or neutralises your flight).
Hidden trade-off	Claims stating that emissions from other activities are not included when offsetting. Claims stating that other greenhouse gases or emissions are not accounted for when offsetting. Claims stating the benefits of offsetting whilst indicating that flying still has an impact on the	Claims focusing on a narrow set of positive attributes and depicts carbon offsetting or carbon offsetting projects in a positive light without considering the negative attributes.

	climate; informing both the positive and negative aspects of a project; or informing about the conditions of offsetting.	Claims providing an absolute figure but do not explain how this relates to the actual emissions of the consumer's flight.
No-proof	Claims providing evidence that something has been done or achieved.	Claims stating that something has been done or achieved without providing evidence.
Vagueness	Claims informing what offsetting means and/or the process of offsetting using comprehensive yet clear and simple language.	Claim not explaining how something will be done, or not providing details. Claims using jargon / complex terminology.
Irrelevance	Claims providing additional relevant information for customers seeking green products (e.g. the projects or calculation methods are disclosed). Claims providing a link with further information.	Claims providing information that is irrelevant for customers seeking green products (e.g. projects are named but not explained).
Lesser of two evils	Claims that are true within their product category and do not distract consumers from greater environmental impacts (e.g. other measures apart from VCO are disclosed, or alternatives to frequent air travel are provided).	Claims that are true within their product category but that distract consumers from greater environmental impacts (e.g. implies that VCO is the best option to mitigate CO_2 emissions, or that it is an easy solution to act green).
Worshiping false labels	Claims providing a credible and reliable certification or verification (e.g. reference to a reliable third-party).	Claims providing a false or non-credible certification or verification (e.g. reference to an untrustworthy third-party).

Source: Author's own elaboration.

198 *Table 3* The coding scheme to assess VCO communication by type of claim.

Type of claim	Trustworthy communication (+1)	Misleading communication (-1)
Product	Claims accurately portraying the ecological attributes of carbon offsetting or the attributes of the airline's offsetting programme.	Claims misrepresenting the ecological attributes of carbon offsetting or the attributes of the airline's offsetting programme.

Process	Claims accurately portraying the operational process of the carbon offsetting programme or the process of carbon offsetting itself.	Claims misrepresenting the operational process of the carbon offsetting programme or the process of carbon offsetting itself.
Fact	Claims involving an independent statement related to the topic of flying / VCO that is factual in nature or its condition.	Claims involving an independent statement related to the topic of flying / VCO that is factual in nature or its condition.
Image	Claims using trustworthy communication to enhance the eco-friendly corporate, and/or social image of the airline through offsetting, and associating the airline with an environmental cause or activity for which there is elevated public support.	Claims using misleading communication to enhance the eco-friendly, corporate, and/or social image of the airline through offsetting, and associating the airline with an environmental cause or activity for which there is elevated public support.

Source: Author's own elaboration.

Following convention (Díaz, Martín-Consuegra and Estelami 2016), two authors tested the coding and undertook the inter-coder reliability on a sample of five websites. Whole sentences were not an appropriate unit of analysis for the sins of *no-proof* and *vagueness*, and we opted to systematically apply the rule that if there was information related to the claim elsewhere on the same webpage, then the sentence did not count as committing the sin. The first reliability test scored an agreement of 84%; therefore, the coding was compared and adjusted, leading to a second reliability test score of 98% agreement.

Care was taken to ensure consistency and demonstrate objectivity and sensitivity to subtle cues in meaning (Bowen 2009). We aimed to make sense of the words used and interpret their role in creating trustworthy or misleading VCO communication. Automated Leximancer 4.5. software was selected for its suitability for exploratory studies, its reliability and objectivity to reduce researcher bias, and its ability to identify and visually represent semantic patterns. Leximancer converts in an unsupervised manner lexical co-

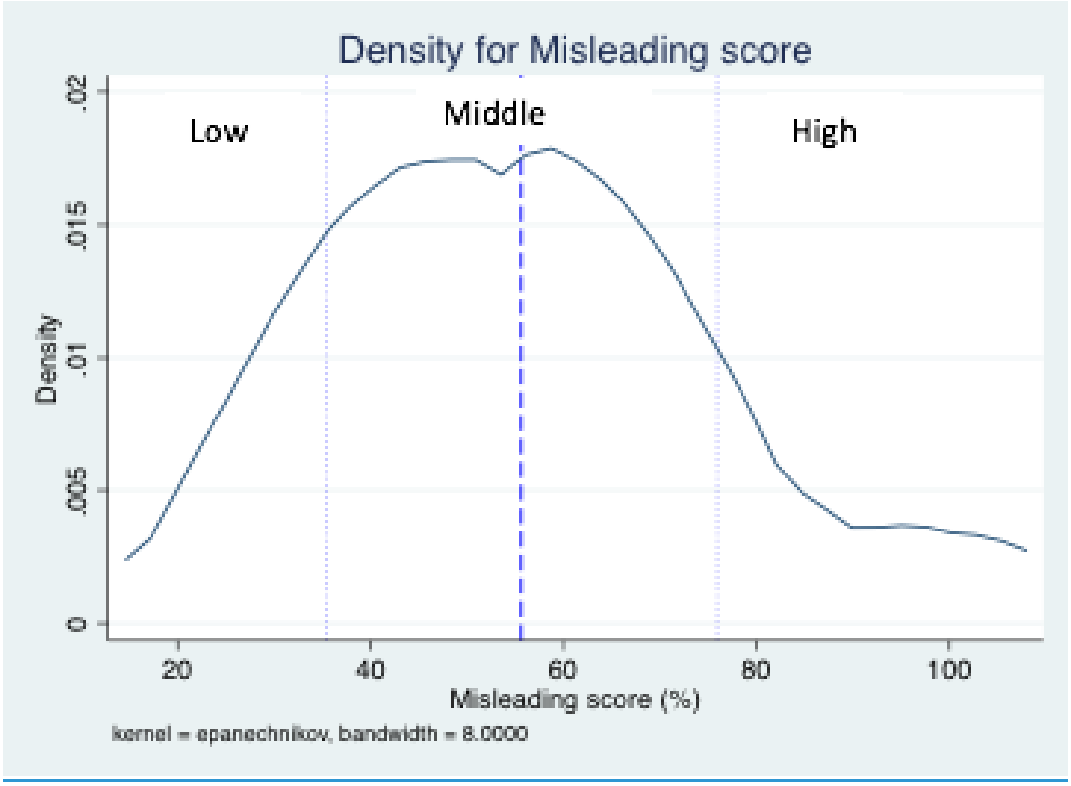
occurrence from natural language into semantic patterns while complying with Krippendorff's validity criteria (Smith & Humphreys, 2006). Leximancer enabled the authors to identify, though various nonlinear dynamics and machine learning algorithms (Smith & Humphreys, 2006), the differences between the main concepts contained within the VCO claims (conceptual content analysis) and the relationships between those concepts based on co-occurrence of concepts (relational analysis). Without an 'a priori' set factors to code VCO concepts, the research team let those concepts and themes emerge automatically from the VCO sentences. Thesaurus learning converged after six and seven iterations to arrive at the final concept definitions for one-sentence segments within the recommended range (Smith & Humphreys, 2006). Leximancer has also been proven reliable with minimal manual intervention from the researcher (Sotiriadou et al., 2014). It is objective as it removes the researchers' bias coder subjectivity and avoids fixation on atypical, anecdotal or erroneous evidence (Smith & Humphreys, 2006). Leximancer is increasingly being used in tourism research to reduce researcher bias by automatically identifying concepts and generating visual concept maps from large volumes of text (e.g., Tseng et al. 2015; Li et al., 2018; Filieri et al., 2021). The software enabled the team to analyse, visualise and interpret the co-occurrence of words in supporting distinct messages in misleading and trustworthy VCO sentence claims.

Linear regressions were applied to study how the following variables affected the quality of VCO communication: 1) the volume of text, 2) the timing of VCO adoption before or after the Becken and Mackey study (2017), 3) the levels of development of the countries of origin of the airlines, according to the United Nations (2020), 4) the VCO certification

234 adopted, and 5) whether the VCO information was available before or after the customer
235 purchased the flight ticket (Table 4).

236 Next, the airlines were grouped in clusters according to their percentage of
237 misleading, trustworthy claims and the amount of text on their website (see Table 1). To
238 create clusters of the airlines, a three-step process was followed; first, the mean of the
239 misleading variable was calculated; second, the standard deviation was calculated; and
240 finally, the thresholds were set at one standard deviation above and below the mean. For
241 example, in the 'misleading claims' clusters, airlines were recorded as: a) *High*, when the
242 misleading percentage was above one standard deviation from the mean, b) *Low*, when
243 the misleading percentage was below one standard deviation from the mean, and c)
244 *Middle*, when the misleading percentage lay between one standard deviation above and
245 below the mean (Figure 2). This was repeated based on the trustworthy claims, and for the
246 length of text, we excluded Air New Zealand because its significantly large volume of
247 information would have distorted the cluster formation.

248 Figure 2: Density for misleading score to define the misleading clusters.



Finally, we employed a discrete choice modelling approach, specifically a Multinomial Logit regression (MNL) with fixed effects estimations, to examine the likelihood of airlines adopting one type of claim or nature of claim over the others, controlled by the timing of adoption of VCO and their countries' levels of development. MNL is a classification method that generalises logistic regression to multiclass problems, i.e., where there are more than two possible discrete outcomes (Greene, 2014), as is the case here, with four and seven alternatives in type and nature of claim respectively. MNL models use the maximum likelihood estimation, which is an iterative procedure (Greene, 2014). We ran a series of nine MNLs using the statistical software Stata (version 16). First, we identified the probability of choosing each type of claim with every nature of the claim (Table 6). Then, we performed separate MNLs for the clusters of misleading, trustworthy, and length of the text to identify first the probability of airlines' choosing each type of claim (Table 7), and

then the probability of choosing each nature of the claim (Annex 4). We used the *Low* cluster as the base category and the number of claims as the unit of analysis. The tables show the coefficient estimates relative to the comparison group.

The MNL was used to model choices as it relies on an assumption of independence of irrelevant alternatives, i.e., the odds of preferring one claim over another do not depend on the presence or absence of other alternatives (Greene, 2014). For example, the relative probabilities of misleading in *product* or *image* do not change if the process is added as an additional option. Accordingly, to measure the categorical variable of choice of the type of claim, we first designated the *product* (type of claim, see Table 3) as the comparison group (i.e., the base category). The choice of misleading in *product* in a given claim was a two-fold dependent variable that included comparing groups with: i) misleading in the *process* compared to misleading in the *product*, and ii) misleading in the *image* compared to misleading in the *product*. Note, we excluded the type of claim *fact* due to its limited use among airlines across the sample, which lead to non-significant results. As described, we ran the MNL with *process* and then *image* as the comparison groups.

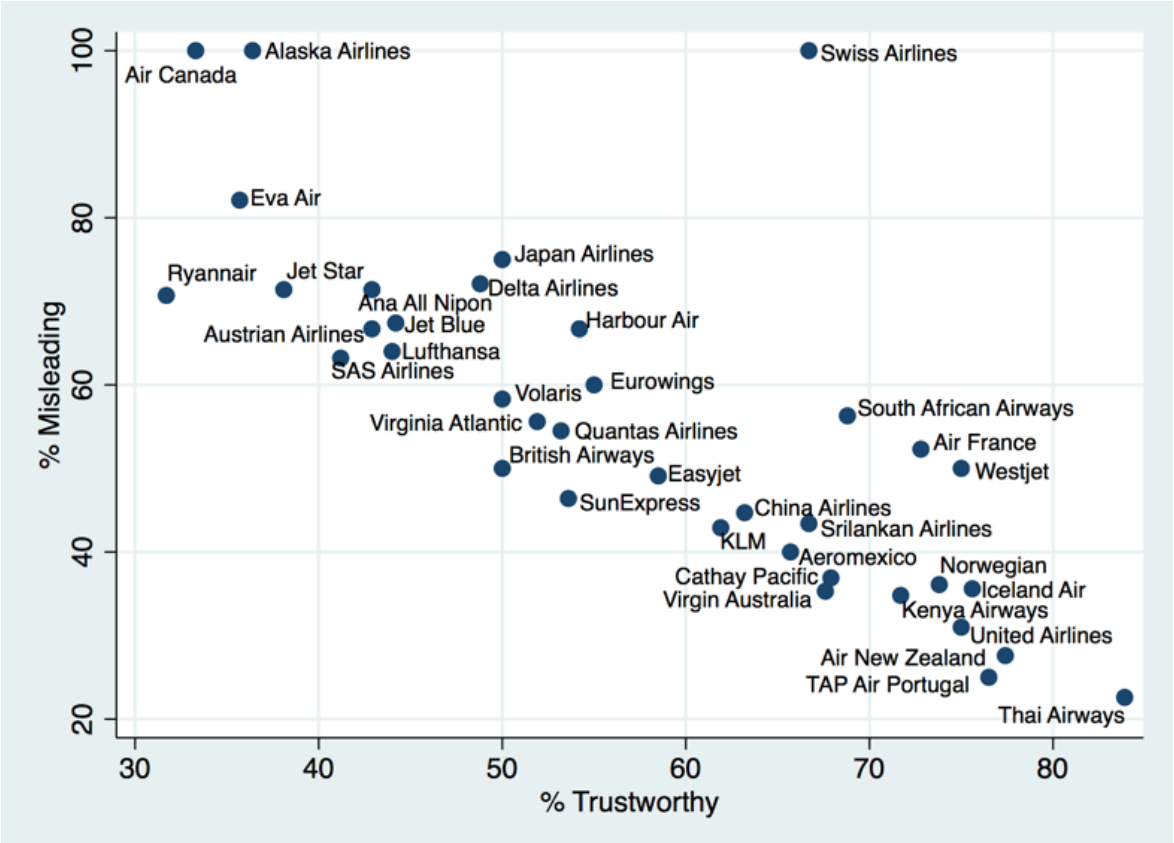
To measure the categorical variable of choice for the *nature of claim*, we designated, individually, each category of the seven *natures* as the comparison group in seven subsequent MNL regressions. In each round, the choice of misleading in the base category for a given claim was one of the seven distinct choice alternatives. We used the likelihood ratio chi^2 test (LR chi2) to validate the models. If statistically significant, this infers the model containing the full set of predictors represents a significant improvement in fit relative to no model. LR chi2 is disclosed as a footnote in the MNL tables.

Results

The number of airlines engaged in VCO dropped over the four years being studied: there were 41 airlines in 2020 compared to 44 in 2016. Ten of the 44 airlines that offered offsetting in 2016 no longer provided this option by 2020, and three further airlines had either merged or stopped operating. However, ten new airlines adopted VCO in the time period; these ten airlines we label *late adopters*, to differentiate them from the 31 *early adopters* that offered VCO before 2016 and continued to do so in 2020. Of the 41 airlines offering VCO in 2020, our analysis was based on the 37 that provided a VCO option to their customers directly on their website, in contrast to the remaining four who redirected their customers to a third-party website. There were no airlines that explicitly stated they did not support VCO.

Comparing 2020 to 2016, 66.7% more airlines offered the offsetting option integrated into their web-sales engines *before* the actual ticket purchase, 82.4% more certified their carbon offsets, 106% more explained the methods used to calculate emissions, and 533% relied significantly on third-party carbon calculators. The percentage of airlines reporting how much carbon was offset had nearly doubled. VCO projects were typically managed by a third company, with the most commonly supported initiative still being energy efficiency or renewables (despite a reduction of 28% since 2016). There was a large increase in forestry protection initiatives (+63%) and reforestation initiatives (+75%). In total, 1,667 VCO communication claims were found in 1,520 sentences. Figure 3 visualises VCO communication patterns per airline with a scatter diagram that shows the percentage of trustworthy vs. misleading claims.

Figure 3. Trustworthy vs misleading communications per airline.



The linear regressions (Table 4) showed that airlines with longer text were statistically less misleading and more trustworthy. Late adopters had longer texts, mislead more and were less trustworthy than the early adopters. Also, airlines from developed countries statistically communicated more misleading information. Having the VCO verified by a third party had no significant effect on the quality or volume of VCO information. However, providing VCO information before the ticket purchase was consistent with more trustworthy messages.

Table 4. Linear regression model (estimates OLS)

	Misleading %	Trustworthy %	Number of sentences
Length of text	-19.132	6.832	
clusters	[4.371]***	[3.763]*	
Timing of VCO	12.255	-9.357	16.003
adoption (Late)	[6.030]**	[5.191]*	[8.939]*

Countries' levels of development (Developed)			10.349 [5.940]*			-6.661 [5.114]			-12.146 [8.939]
VCO verified	-0.396 [9.170]			3.227 [6.570]			-2.366 [11.087]		
Before the ticket purchase		-10.592 [6.647]			9.058 [4.707]*			6.811 [8.401]	
Nº observations	37	37	37	37	37	37	36	36	36
R^2	0.001	0.0676	0.4315	0.0068	0.0957	0.1849	0.0013	0.0190	0.0907

Confidence level (two-tail test): 99% (***), 95% (**), 90% (*)

Airlines most often misled in *product* and *image*, while they seldom misled in *fact* data (Table 5). Airlines most often relied on *vagueness*, *lesser of two evils* and *no proof* when misleading. Table 6 shows that negative coefficients in MNL on nature of claim can be interpreted that the nature is less likely to occur than the base category, while positive coefficients suggest the nature is more likely to occur. Misleading in *product* significantly increased the odds of choosing *fibbing*, *vagueness* and *lesser of two evils* as tactics to deceive customers (Table 6 subsection 1). Airlines misleading in *process* were also more likely to mislead by employing the *lesser of two evils* as a greenwashing tactic. For *image* claims, airlines had a higher probability to employ *hidden trade-off*, *no proof* and *irrelevance* claims, and a lower probability to mislead using *lesser of two evils*. It is noteworthy that no airline provided false claims regarding VCO third-party certification.

Table 5. Nature vs type of claim matrix (number of claims).

	Product		Process		Fact		Image		*TOTAL*	
	Trustworthy	Misleading	Trustworthy	Misleading	Trustworthy	Misleading	Trustworthy	Misleading	Trustworthy	Misleading
Fibbing	12	48	10	6	20	2	3	14	*45*	*70*
Hidden trade-off	14	16	24	9	13	4	7	61	*58*	*90*
No proof	1	30	0	14	0	1	2	75	*3*	*120*
Vagueness	74	104	36	11	3	0	4	88	*117*	*203*
Irrelevance	187	11	133	4	13	1	163	57	*496*	*73*
Lesser of two evils	16	91	0	34	2	2	29	44	*47*	*171*
Worshipping false labels	34	0	31	0	0	0	107	2	*172*	*2*
TOTAL	*338*	*300*	*234*	*78*	*51*	*10*	*315*	*341*	***938***	***729***

Overall, 56% of the carbon offsetting claims were trustworthy (938 over 1,667 claims). Airlines, more often than not, were trustworthy in relation to their *product* and *image*. Being trustworthy in *product* increased the odds of providing relevant information, while in *image* it was more likely to provide a reliable third-party certification (Table 6 subsection 2). Airlines were generally trustworthy in the operational *process* of carbon offsetting and, statistically, they were likely to inform both on the positive and negative aspects of VCO. However, nearly no airline provided evidence to back up the claims they made.

Table 6: Multinomial logit regression by type of claim and nature of claim (estimates maximum likelihood)

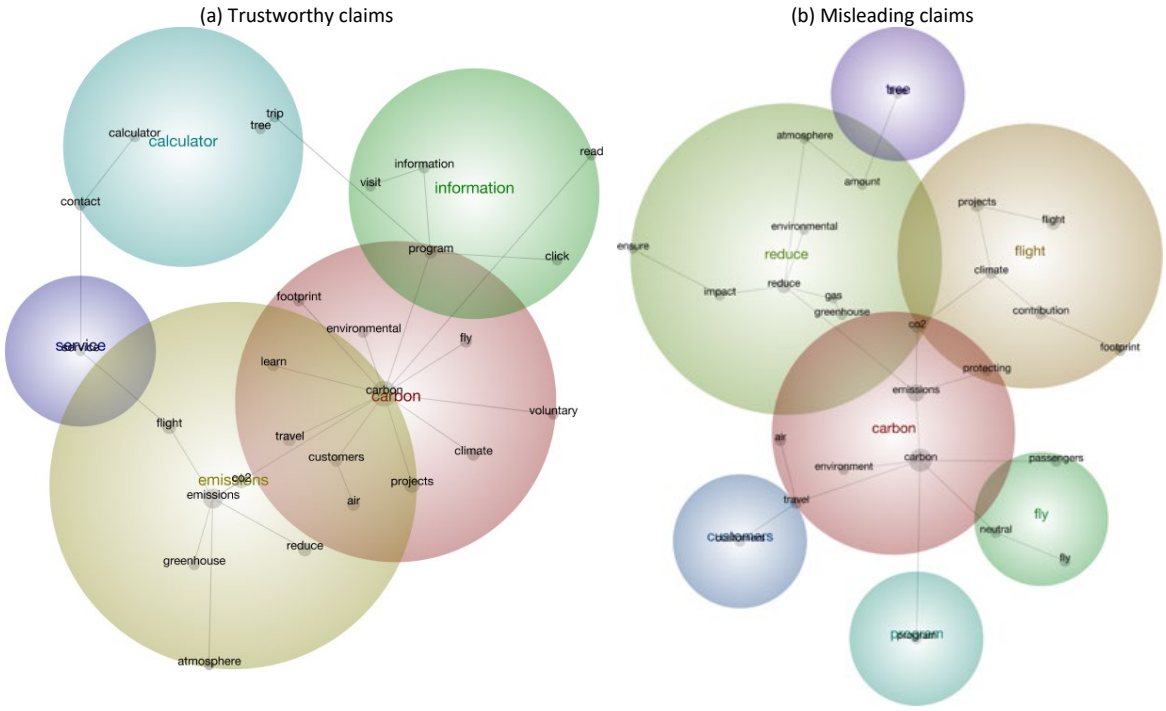
Base outcome	Fibbing		Hidden trade-off		No-proof		Vagueness		Irrelevance		Lesser of two evils	
	Process	Image	Process	Image	Process	Image	Process	Image	Process	Image	Process	Image
(6.1.) Misleading claims												
Hidden trade-off	1.386 [0.595]**	2.452 [0.405]***										
No-proof	1.386 [0.542]**	2.217 [0.375]***	0.000 [0.523]	-0.235 [0.347]								
Vagueness	-0.167 [0.536]	1.0064 [0.337]***	-1.553 [0.516]***	-1.445 [0.305]***	-1.553 [0.455]***	-1.210 [0.265]***						
Irrelevance	1.290 [0.691]*	2.960 [0.446]***	-0.095 [0.676]	0.508 [0.423]	-0.095 [0.630]	0.743 [0.395]*	1.457 [0.625]**	1.954 [0.358]***				
Lesser of two evils	1.145 [0.479]**	0.585 [0.356]*	-0.241 [0.457]	-1.867 [0.326]***	-0.241 [0.386]	-1.631 [0.289]***	1.312 [0.377]***	-0.421 [0.237]*	-0.145 [0.577]	-2.375 [0.376]***		
Worshiping false labels	-12.302 [501.769]	-0.020 [0.857]	-13.689 [501.769]	-2.473 [0.845]***	-13.689 [501.769]	-2.238 [0.831]***	-12.135 [501.769]	-1.027 [0.815]	-13.593 [501.769]	-2.981 [0.865]***	-13.447 [501.769]	-0.606 [0.823]
(6.2.) Trustworthy claims												
Hidden trade-off	0.721 [0.5444]	0.693 [0.794]										
No-proof	-16.775 [4813.362]	2.079 [1.384]	-17.497 [4813.362]	1.386 [1.309]								
Vagueness	-0.360 [0.469]	-0.209 [0.704]	-1.081 [0.387]***	-0.902 [0.542]*	16.415 [4813.359]	-2.288 [1.257]*						
Irrelevance	-0.212 [0.443]	1.179 [0.654]*	-0.933 [0.355]***	0.486 [0.475]	16.563 [4813.359]	-0.900 [1.229]	0.148 [0.223]	1.388 [0.303]***				
Lesser of two evils	-16.840 [1242.805]	1.980 [0.716]***	-17.561 [1242.805]	1.287 [0.557]**	-0.064 [4971.216]	-0.098 [1.263]	-16.480 [1242.805]	2.190 [0.420]***	-16.628 [1242.805]	0.801 [0.330]**		
Worshiping false labels	0.090 [0.494]	2.532 [0.674]***	-0.631 [0.418]	1.839 [0.503]***	16.865 [4813.359]	0.453 [1.240]	0.450 [0.313]	2.742 [0.344]***	0.302 [0.273]	1.353 [0.225]***	16.930 [1242.805]	0.551 [0.368]

Note: Confidence level (two-tail test): 99% (***), 95% (**), 90% (*).
Model (6.1.) Nº observations (719), LR chi2 (12) 145.31, Prob > chi2 0.0000. Model (6.2.) Nº observations (887), LR chi2 (12) 153.31, Prob > chi2 0.0000.

342 The visual concept maps from Leximancer enabled us to identify frequently occurring
343 lexical concepts used across the airlines' VCO communications, and showcased the role of
344 co-occurrence of words in supporting distinct messages in misleading and trustworthy
345 claims (Annex 1). Across all 1,667 claims, Leximancer automatically extracted 28 themes
346 (Annex 2) and 88 word-like concepts that were relevant by type of claim. The seven
347 concepts of 'carbon', 'emissions', 'projects', 'offset', 'calculator', 'flight' and 'credits' were
348 common amongst the top-10 ranked concepts in both misleading and trustworthy VCO
349 messages (Annex 3). The remaining three concepts from the top-10 were 'CO_2', 'fuel' and
350 'climate' for the trustworthy claims and 'reduce', 'tree' and 'travel' for the misleading
351 claims. Only trustworthy claims referred to the themes of: Climate, Air, Support, Calculator,
352 Electricity and Energy, and the concepts of: 'effect', 'measure', 'process', 'negative',
353 'verified', 'deforestation', 'learn', 'read', 'contact' and 'service.' In contrast, themes
354 particular to misleading claims included: Communities, Planet, Tree, Programme or
355 Customer, and concepts of: 'forest', 'passenger', 'neutral', 'compliance' and 'protecting.'
356 Figure 4 illustrates how trustworthy claims enhanced the credibility of the offset
357 *product* by referring to Carbon (with concepts such as 'footprint'), Emissions ('atmosphere',
358 'greenhouse', 'gas'), Information ('programme', 'visit', 'read'), Calculator ('contact') and
359 Service. Meanwhile, misleading *product* claims relied on themes and concepts such as
360 Carbon ('protecting', 'environment'), Reduce ('impact', 'greenhouse', 'gas'), Tree, Fly
361 ('neutral', 'passengers') and Customers. Trustworthy *image* claims relied on specific
362 concepts to enhance an eco-friendly corporate image such as Carbon ('verified'), Climate
363 ('impact'), Air ('footprint'), Support ('deforestation') and Electricity. Misleading *image*
364 claims were couched in broader themes such as Sustainable, Communities ('forest', 'trees'),

Planet or Global. We also found similar lexical differences with *process* and *fact* claims, as can be seen in Annex 1.

Figure 4: *Conceptual map of the themes and concepts for product claims*.



Note: Themes are the colored circles that group clusters of concepts. The map's heat denotes the most relevant concepts (red, orange) and the least relevant (blue, green). The size of the concept dot denotes the connectivity and is calculated as the sum of all word co-occurrence counts between the concept itself and every other concept on the map.

There was consistency in the Leximancer results between the nature, and the type, of claims. For example, the Reduce theme (including the concepts of 'impact', 'greenhouse' and 'gas') and the Fly theme ('neutral') were common to both the misleading *product* claims and the *fibbing* nature of claim, which contributed to misrepresenting the scientific realities of flying (Annex 1.1.b). The Carbon theme ('protecting' and 'environment) and Tree theme ('trees') were present in both the misleading *product* claims and the *lesser of two evils* claims. Similarly, themes such as Sustainable ('environment'), Communities ('forest', 'trees' and 'support'), Planet and Global, were common in *image* misleading claims (Annex 1.2.b). Those concepts were used to depict carbon offsetting in a positive light without

considering its negative attributes (*hidden trade-offs*). Emissions ('compliance', 'scheme' or 'trading'), Retired (related to carbon credits) and Contribution ('offset') were all misleading *process* claims that supported the *lesser of two evils*, implying VCO is the best option to mitigate CO_2 emissions (Annex 1.3.b).

We now review the data by airline. Four out of the six least misleading airlines were among the eight highest trustworthy airlines and three out of the four highest misleading were among the lowest trustworthy cluster (Figures 5 and 6). While there was an inverse relationship between the percentage of misleading and trustworthy claims, clustering evidenced a one-to-one relationship only for some airlines.

Figure 5: Airline clusters from highest to lowest percentage of misleading communication.

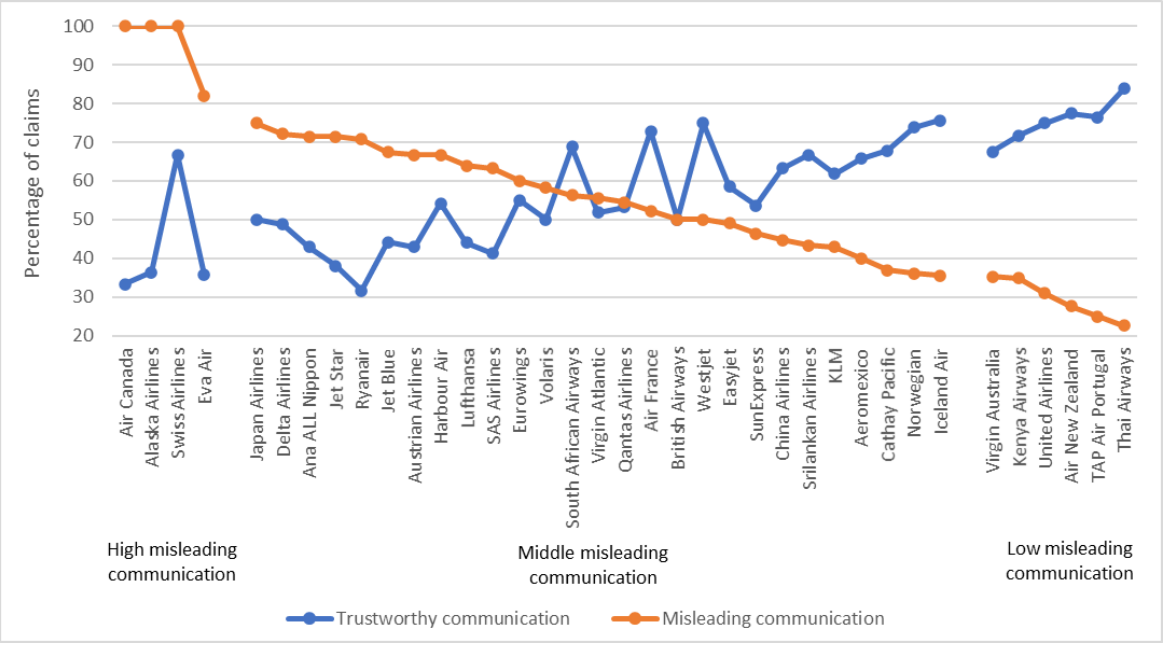
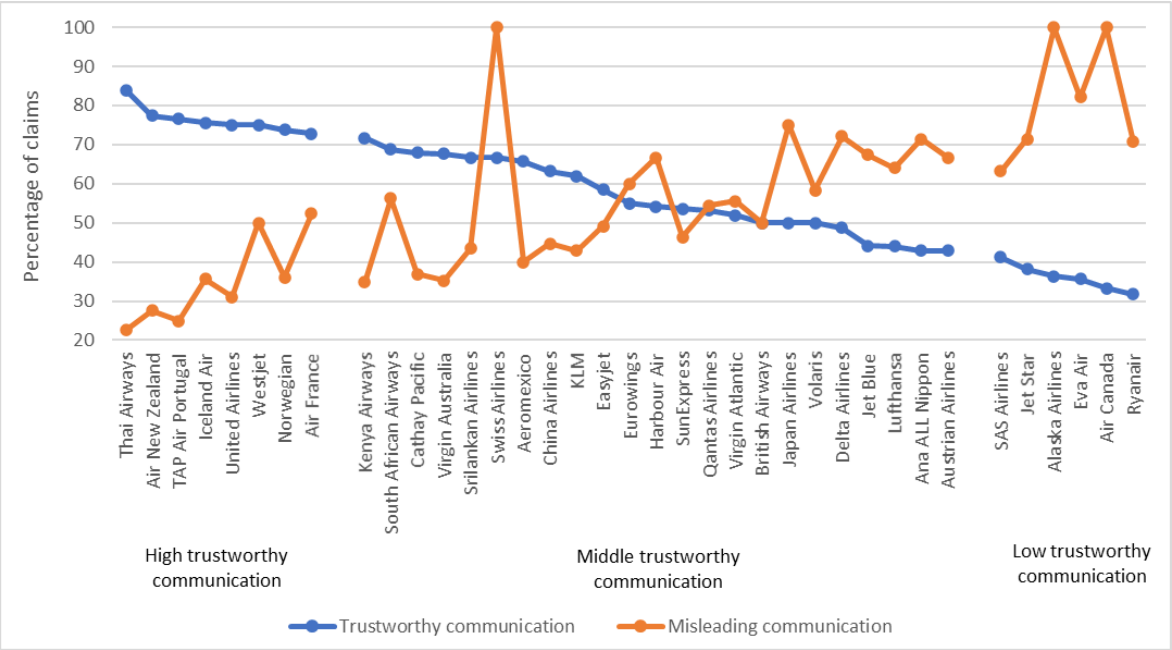


Figure 6: Airline clusters from highest to lowest percentage of trustworthy communication.



We sought to understand further the practices of VCO communication both in relation to the type (Table 7) and nature of claims made (Table 8). Airlines in both the High and Middle misleading clusters were more likely to mislead in their *product* than *process* claims and, also, more likely to mislead in their *image* than *process* claims, relative to airlines in the Low misleading cluster (Table 7 subsection 1). High misleading airlines were more likely to employ fibbing as a deception tactic, followed by vagueness and lesser of two evils (Annex 4.1). Those airlines in the Middle misleading cluster communicated VCO more often by *fibbing*, *hidden trade-offs*, *vagueness*, *irrelevance* and *lesser of two evils*, while they were less likely than High misleading airlines to make claims categorised as *no-proof* and *worshiping false labels*.

High trustworthy airlines were more likely to communicate truthful claims in relation to their *process* and *image* rather than their *product* claims (Table 7 subsection 2). Regarding nature of claim (Annex 4.2), High and Middle trustworthy airlines were more likely to communicate VCO content that was less *vague*. High trustworthy airlines were less

likely to choose *lesser of two evils*, and Middle trustworthy airlines were more likely to provide additional relevant information (*vagueness*), compared to Low trustworthiness airlines.

Table 7: Multinomial logit regression by type of claim (estimates maximum likelihood)

Base outcome	Product	Image	Process
	Process	Product	Image
(7.1.) MISLEADING CLUSTERS			
Middle	-0.979 [0.328]***	0.083 [0.235]	1.063 [0.324]***
High	-2.457 [0.833]***	-0.531 [0.396]	1.926 [0.839]**
Timing of VCO adoption (Late)	0.237 [0.308]	0.078 [0.176]	-0.159 [0.303]
Countries' levels of development (Developed)	-0.945 [0.281]***	-0.129 [0.195]	0.815 [0.274]***
(7.2.) TRUSTWORTHY CLUSTERS			
Middle	-0.492 [0.365]	0.133 [0.302]	0.625 [0.375]**
High	0.717 [0.358]**	0.167 [0.310]	-0.550 [0.369]
Timing of VCO adoption (Late)	-0.470 [0.212]**	0.002 [0.177]	0.473 [0.215]**
Countries' levels of development (Developed)	-0.582 [0.222]***	-0.038 [0.192]	0.544 [0.225]**
(7.3.) LENGTH OF TEXT CLUSTER (Misleading)			
Middle	14.620 [646.683]	0.743 [0.343]**	-13.876 [646.683]
High	15.705 [646.683]	1.113 [0.356]***	-14.591 [646.683]
Timing of VCO adoption (Late)	-0.493 [0.283]*	-0.050 [0.168]	0.442 [0.276]
Countries' levels of development (Developed)	-0.835 [0.281]***	-0.078 [0.193]	0.756 [0.272]***
(7.4.) LENGTH OF TEXT CLUSTER (Trustworthy)			
Middle	0.772 [0.573]	1.467 [0.566]***	0.695 [0.720]
High	1.561 [0.571]***	1.360 [0.569]**	-0.200 [0.719]
Timing of VCO adoption (Late)	-0.649 [0.205]***	-0.043 [0.170]	0.605 [0.205]***
Countries' levels of development (Developed)	-0.104 [0.196]	-0.020 [0.177]	0.083 [0.198]

Note: Confidence level (two-tail test): 99% (***), 95% (**), 90% (*).
Model (7.1.) Nº observations (719), LR chi2 (8) 27.48, Prob > chi2 0.0006.
Model (7.2.) Nº observations (887), LR chi2 (8) 53.56, Prob > chi2 0.0000.
Model (7.3.) Nº observations (719), LR chi2 (8) 43.86, Prob > chi2 0.0000.
Model (7.4.) Nº observations (887), LR chi2 (8) 48.44, Prob > chi2 0.0000.

Airlines with longer text were more likely to mislead in their *image* than in their *product* claims (Table 7 subsection 3). In contrast, airlines with a Small amount of VCO text were more likely to mislead in their *product*. Airlines providing more VCO information were more likely to mislead through *hidden trade-offs*, *no-proof* and *irrelevance*, than were those airlines with shorter texts (Annex 4.3). Middle-text airlines were most likely to mislead as a result of text *irrelevance*, while those airlines with a Small amount of text did so by *fibbing*. Regarding trustworthy claims, both Large and Middle amounts of text were more likely to present a trustful *image* than *product* (Table 7 subsection 4). Also, for the Large amount of text cluster, airlines were more likely to provide trustworthy *process* than *product* claims. Notably, the text's length did not significantly affect how they communicated trustworthy VCO claims (Annex 4.4).

Next, the results showed that both the timing of adoption and the airline's country of origin's level of development affected the quality of VCO communication. Late VCO adopters had statistically significant longer text and had, both, more misleading and fewer trustworthy claims. Also, while the timing of VCO adoption did not significantly affect an airline's type of claims, it did affect the nature of their claims. The MNL showed a significantly higher probability of late VCO adopters misleading as a result of the *lesser of two evils*, *hidden trade-offs* and *irrelevance*, than the other signs of greenwashing, compared to early VCO adopters (Annex 4.1). Contrarily, early VCO adopters were more likely to employ *fibbing* as a misleading practice. Late VCO adopters were more likely to be trustworthy in their *product* and *image* claims, than they were in their *process* claims. The timing of VCO adoption did not affect the airlines' trustworthiness in relation to the nature of their claims.

Finally, we compared airlines from developed and developing countries. We found that belonging to developed countries increased the probability of misleading in *product* over *process*, and *image* over *process* compared to airlines from developing countries (Table 7 section 1). Airlines from developed countries also were more likely than airlines from developing countries to be trustworthy by portraying the ecological attributes of VCO *product* more often than *process* claims, and by enhancing the eco-friendly *image* rather than the *process*. With few exceptions, the airlines' countries' levels of development did not significantly affect their choices of nature of claims being misleading or trustworthy. Airlines from developed countries had a higher probability of employing *irrelevant* misleading claims and were more likely to communicate trustworthy claims in relation to the *lesser of two evils* criterion (Annex 4.1). Airlines from developing countries had a higher probability of being trustworthy in relation to *vague* claims.

Discussion

Greenwashing is overly present in consumer online purchase experiences. Over 40% of companies' green claims online mislead consumers across sectors (UK Competition and Market Authority, 2021); a statistic that highlights the importance of examining misleading communication closer. This study first contributes with a new classification method to analyse the type (what to communicate about) and nature (how to communicate about it) in relation to sustainability practices. This study complements past research examining aviation offset communication, which took a narrower focus on greenwashing (Polonsky and Garma 2008; Polonsky et al. 2010) or implicitly assessed communication (Becken and Mackey 2017). It provides empirical evidence of the airlines' choices in making misleading or trustworthy claims on their websites, the differences in their lexical choices and concepts

463 carried, and examples of messages that consumers face when considering whether to
464 purchase a carbon offset.

465 A key contribution from this study is the analysis of trustworthy communication, as
466 previous studies have had a narrow focus on greenwashing that ignored the fact that over
467 50% of the VCO claims made are trustworthy. We show how communication can be both
468 misleading and trustworthy simultaneously, about different types and natures of claims,
469 which may hinder a correct interpretation of environmental features of a product and
470 increase green consumer confusion (Chen and Chan, 2013). Airlines tend to display
471 misleading communication on *product* and *image* claims that are less easily verifiable and
472 rely on broad, subjective and ambiguous themes (e.g., Sustainable, Communities and
473 Planet). However, airlines provide trustworthy communication in their *process* and *fact*
474 claims, supported by concepts that are more easily verifiable (e.g., 'certified', 'gold
475 standard'). In other contexts, misleading through different nature of claims affected how
476 consumers perceived greenwashing, with vague claims remaining unnoticed while false
477 claims negatively affecting consumers' attitudes (Schmuck et al., 2018). Therefore, such a
478 communication strategy may serve an airline's desire to display a green image while
479 avoiding accusations of greenwashing and still attract the majority of customers that lack
480 knowledge on VCO (Gössling et al. 2009; Ritchie et al. 2020) and may not distinguish
481 between trustworthy and misleading claims.

482 As consumers are increasingly confronted with 'flying shame' debates and the
483 'flying dilemma' (Higham et al. 2014; Gössling et al. 2019), misleading product claims
484 exploit the consumers' moral concerns for air travel. Airlines frame VCO as an effective
485 answer to achieve sustainable aviation. For example, "We know carbon offsetting is not

perfect, but right now we believe it's the best way to address the carbon emitted from flying" (Easyjet). However, VCO is an insufficient activity alone to reach carbon-neutral aviation (Scott et al. 2016; Leamon et al. 2019). Airlines frame VCO as a simple, easy and cheap solution with claims such as "We make it easy to offset your flight's carbon emissions" (Air New Zealand) or "Reduce the environmental impact of your travel for about the price of a cup of coffee" (Jet Blue). Airlines today imply that VCO is an inexpensive and effective solution, just as they did over a decade ago (Smith 2007).

Claims are often vague, as evidenced by Lufthansa's "You can make a voluntary donation through our partner 'my climate' to offset the CO2 emissions of your flight", without explaining what offset means or how it works. Airlines frame VCO as bringing co-benefits for the environment/society and the customer, which may increase consumers' willingness to pay for offsets (MacKerron et al. 2009). For example, Air France state that "You have the opportunity to contribute to a reforestation and human development project … by donating an amount of your choice" and then "considered as a donation, it also allows customers with tax residency in France to benefit from a tax reduction."

The language used in VCO messages suggests that it can be a discursive device that removes environmental concerns from the conversation on the responsibility of flying, which supports previous research (Zhang et al. 2018; Zhang et al. 2019a). Airlines draw on moral licensing by which "the purchase of a carbon offset may license a traveller to do something morally questionable, like contributing to carbon emissions, while maintaining a positive view of her morality" (Miller and Effron 2010, 127). Airlines draw on the moral credits model by which a prior good deed (VCO) provides a license to engage in 'immoral' behaviour (flying), since VCO is used to morally 'balance out' one's harm to the

environment (Blanken, van de Ven, and Zeelenberg 2015). VCO communication sells self-approval to the customer (Smith 2007) that may prevent them from changing their behaviour (Dhanda and Hartman 2011) and lead to a significant increase of emissions (Gössling et al. 2007).

Airlines continue to misrepresent the scientific realities of flying or offsetting in their claims (Burns and Cowlishaw 2014). The Leximancer analysis shows that *product* claims often mislead in relation to VCO's ability to reduce 'impact,' 'greenhouse,' 'gas' and 'emissions'. Airlines often frame VCO as an option "to help the global community reduce carbon emissions from our atmosphere" (e.g., Air Canada) although emissions are not reduced as they are still being released into the atmosphere (Becken and Mackey 2017). Regardless of their level of trustworthiness, more than half of the airlines name their VCO product/programme as 'Fly (carbon) Neutral,' despite the fact that offsetting does not neutralise emissions, it merely partially compensates for them (Gössling et al., 2009). Such claims "mislead by intentionally presenting an image that does not accurately represent environmental costs and benefits" (Forbes and Jermier, 2012, 360). The Leximancer analysis shows an over use of imprecise terms such as 'environment' and 'protecting' in misleading *product* claims and ambiguous terms such as 'reduce' and 'offset' in misleading *image* and *process* claims. Such claims steer VCO's shared meaning into a symbol representing the abstract concept of flying as a behaviour that does not damage the environment.

There is some evidence of airlines lacking proof behind their depiction of VCO, such as claims of being the greenest, offsetting all of their employees' travels, or investing in projects of the "highest" quality. To exemplify, Ryanair claims to be "the Number 1 for

532 Carbon Efficiency and we will continue to lead the way," and Virgin Australia announces
533 that it "offsets all emissions from any business travel for all of our employees." Without
534 evidence, such claims can generate customer distrust and perpetuate their lack of
535 credibility (Burns and Cowlishaw 2014; Zhang et al. 2019b). Besides, airlines continue to
536 communicate only the positive attributes of offsetting (Polonsky et al. 2010; Kim et al.
537 2016).

538 VCO communication contributes to creating a superior eco-positioning of airlines.
539 Half of all aviation industry *image* and *product* claims are misleading, regardless of when
540 the airlines adopted an approach to VCO and regardless of the volume of VCO information
541 displayed on their websites. Appealing to consumers' emotional affinity toward nature may
542 effectively persuade consumers toward brands regardless of their perceived greenwashing
543 (Schmuck 2018). Contributions to energy-related projects, forest protection and
544 reforestation initiatives have increased considerably since 2016, and were reflected on the
545 emergence of themes as Electricity and Energy in trustworthy claims and themes as Trees,
546 Sustainable, or Planet in misleading claims. Airlines often incorporate claims such as Air
547 France's "110,000 trees were planted in 2009" and Air New Zealand's "half of the carbon
548 emitted is offset with carbon credits generated from permanent native forestry projects in
549 New Zealand." Such projects enhance the organisation's eco-friendly image by tapping into
550 the symbolic meaning of trees in the minds of customers and symbolically connecting
551 passengers to the abstract idea of greening.

552 A key contribution to our understanding of VCO communication is that the level of
553 development of the airline's country of origin matters, as airlines from developed countries
554 mislead significantly more in carbon offsetting *product* and *image* claims than do those

555 from developing countries. Their VCO communication signifies a commitment to fighting
556 climate change that may not necessarily parallel their environmental performance (Mayer
557 et al. 2015).

558 Airlines have appropriated the language and images of ecology and reframed the
559 environmental discussion of flying and climate change from a source of problems to a
560 source of solutions that signal corporate control over greening rhetoric. For example,
561 Cathay Pacific states that "to be part of the solution, we invite customers to use Fly
562 Greener… to make greener choices while you travel" and Austrian Airlines claim that "we
563 have been working for years now to reduce our CO_2 emissions… Now you can join us and
564 our partner in making your own personal contribution to climate protection." The VCO
565 engagement-oriented marketing invites consumers to be an active participant in airlines'
566 solutions to climate change (Kim, et al. 2016); an environmental discourse that could be
567 used, detrimentally, to "limit the subject, scope and boundaries of the controversy" of
568 flying (Beder 1997, 282–283).

569 In addition, a novel, and concerning finding is that third-party VCO certification does
570 not improve communication quality. While having a certified carbon offset programme
571 signals credibility (Zhang et al., 2019a; Ritchie et al., 2021), we find airlines with such
572 programmes employ dubious marketing claims on their websites. Thus, misleading claims
573 may remain unnoticed by customers as studies show third-party certification increases
574 willingness to purchase offsets (Liu et al. 2015; Ritchie et al., 2021).

575 A further contribution from this study is the evidence that airlines are generally
576 trustworthy in VCO *process* and *fact* claims, and that both experience in VCO and
577 information before the ticket purchase do matter when communicating VCO. Compared to

578 2016 (Becken and Mackey 2017), the number of airlines that disclose their calculation
579 methods has more than doubled and the number that explain how much carbon is offset
580 has nearly doubled, albeit, it remains disclosed as an absolute and non-comparable
581 number. Airlines substantially frame VCO less often incorrectly from a scientific point of
582 view (fibbing). Also, our findings show that those airlines with more experience in VCO, and
583 those that dedicate more space on their website to communicate their VCO practices, are
584 more trustworthy than the average airline (e.g. Air New Zealand). By providing 'action
585 knowledge' (Kim et al. 2016), and expanding on process information, the airlines may
586 attract knowledgeable consumers more effectively. We also find both a growth of 65% in
587 airlines offering VCO before the actual ticket purchase (rather than after), and that this
588 option leads to significantly more trustworthy claims, which may arguably be more
589 effective in increasing customers' purchase intentions of VCO (Zhang et al., 2019b). While
590 previous studies identified greenwashing for the whole airline industry (Gössling et al.
591 2007; Polonsky et al. 2010; Babakhani et al. 2017), our results offer new light into the
592 characteristics of airlines that lead them to provide a higher quality of VCO communication
593 on their websites; it also illuminates their specific communication choices.

594 Our research offers new insights on the presence and extent of obfuscation across
595 airlines' websites (from the volume of text, the intensity of misleading and the choice of
596 the deceptive tactics (nature of the claim)) and how this may impact the clarity and
597 comprehensiveness of the VCO message to their consumers. Late VCO adopters write
598 messages with a lower reading ease, a characteristic that contributes to obfuscation (Curtis,
599 2004) and increases green consumer confusion (Chen and Chang, 2013). They display
600 lengthy texts, and several mislead three times more than provide trustworthy information
601 (e.g., Alaska Airlines, Eva Air, and Ryanair). Also, the use of jargon without explanation

(vagueness) (Kim et al. 2016; Liu et al. 2016), the use of irrelevant information (irrelevant), and claims that distract consumers from greater environmental impacts (lesser of two evils), arguably contribute to low reading ease of the messages. As there is limited research on obfuscation (Curtis, 2004) and empirical assessments of communication of carbon offsets (Becken and Mackey, 2017), we contribute by identifying ways by which consumers are more likely to be distracted with misinformation concerning airlines' contributions to climate change.

While greenwashing by obfuscation may be subtle, as Courtis (2004, 292) states "the greater the subtlety, the more the manipulation may succeed." The lexical analysis evidenced an added layer of complexity for consumers, namely, their ability to distinguish between misleading and trustworthy claims delivered by airlines as part of their green marketing discourse strategies in a bid to control the narrative of VCOs. Thus, with a lack of VCO standardisation (MacKerron et al. 2009; Dhanda 2014) and aware consumers (Gössling et al. 2009), the aviation industry, and late VCO adopters in particular, can easily appropriate the discourse of fighting climate change. The identified mix of trustworthy and misleading communication may serve the airlines to eco-position their brand, morally license customers to continue flying and reduce pressure for technological innovations towards a carbon neutral aviation.

Conclusion

This article has empirically demonstrated which characteristics of an airline and its VCO programme explain the quality of its VCO communication and illustrates specific communication and lexical choices. We contribute to the literature by examining the relative preferences of airlines on what to communicate (type of claim) and how to

communicate it (nature of claim) by taking into account both misleading and trustworthy claims. Prior research on VCO has exclusively focused on misleading communication (Polonsky and Garma 2008; Polonsky et al. 2010). The taxonomy developed allows to conduct a more nuanced analysis of greenwashing. Theoretically, this research contributes to the literature on environmental marketing, corporate greening and carbon offsetting, by showing the value of conducting a more detailed analysis of VCO communication beyond seeking out misleading claims only and, instead, also analysing trustworthy messages. This classification enabled us to better understand communication as a continuum from the usually labelled greenwashing to meaningful communication. We make a methodological contribution by providing a coding framework of trustworthy and misleading communication that can be tested in other contexts. The lexical analysis supports the taxonomy developed, enriching the domain of greenwashing with an exploratory linguistic perspective that has seldom been studied before (e.g., Gautami, Suganthi, Sivakumaran, 2014; Siano, Vollero, Conte and Amabile, 2017).

We delved into the specific ways in which customers face deceptive and obfuscated communication that is difficult to acknowledge, discern or verify, because it lacks proof, is vague, is oversold without considering the limitations of VCO and/or misrepresents the scientific realities of flying or offsetting. Airlines provide persuasive arguments for their business model by shifting responsibility to customers in framing VCO as 'the' solution for customers to act green; they highlight benefits for the customer and the environment while providing the moral license to continue flying. In practice, such detailed analyses enable us to also engage with the airline industry with specific examples on how to improve communication that is currently misleading on a multitude of aspects relating to the nature and type of claims.

This study has several limitations. First, this study sheds light on the role of words in VCO green marketing through an exploratory lexical analysis; future research can employ advanced linguistic and semantic analysis. Second, we offer a glimpse of carbon offset corporate communications and pave the way for future consumer behaviour research. Studies on the effect of perceived greenwashing on consumers are still limited and show a negative impact on attitudes towards brands, trust, or perceived brand integrity (Chen and Chang, 2013; Schmucks et al., 2018; Szabo and Webster, 2021). Yet no study has considered different types and natures of misleading nor a hedonic product, such as flying. Can customers disentangle obfuscation and misleading claims from trustworthy VCO messages? Future work may draw on the proposed taxonomy in advancing the nascent literature on perceived greenwashing's effect on consumer decisions (Schmuck et al., 2018; Wang et al., 2019) and on consumer's distrust in VCOs (Zhang et al., 2019b). Finally, we provide a nuanced understanding of current VCO messages and contribute valuable insights to support existing efforts to improve the persuasiveness of VCO messages to alter consumer behaviours (e.g., Zhang et al., 2019a; Richie et al., 2021); for example, whether misleading tactics lead to increased purchase intent or willingness-to-pay in voluntary carbon offsets. Going forward, those, and other, related questions may be addressed through discrete choice experiments that systematically vary message attributes by the type and nature of the claims.

References

Airlines for America. (2018). *World Airlines Traffic and Capacity.* Retrieved June 28, 2020, from https://www.airlines.org/dataset/world-airlines-traffic-and-capacity/#

671 Amankwah-Amoah, J. (2020). Stepping up and stepping out of COVID-19: New challenges
672 for environmental sustainability policies in the global airline industry. *Journal of Cleaner*
673 *Production*, *271*, 123000.

674 Babakhani, N., Ritchie, B. W., & Dolnicar, S. (2017). Improving carbon offsetting appeals in
675 online airplane ticket purchasing: Testing new messages, and using new test
676 methods. *Journal of Sustainable Tourism*, *25*(7), 955-969.

677 Becken, S., & Mackey, B. (2017). What role for offsetting aviation greenhouse gas emissions
678 in a deep-cut carbon world?. *Journal of Air Transport Management*, *63*, 71-83.

679 Becken, S. (2019). Decarbonising tourism: Mission impossible?. *Tourism Recreation*
680 *Research*, *44*(4), 419-433.

681 Beder, S. (1997). *Global Spin: The Corporate Assault on Environmentalism*. Devon: Green
682 Books.

683 Blanken, I., van de Ven, N., & Zeelenberg, M. (2015). A meta-analytic review of moral
684 licensing. *Personality and Social Psychology Bulletin*, *41*(4), 540-558.

685 Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative*
686 *research journal*, *9*(2), 27-40.

687 Burns, P. M., & Cowlishaw, C. (2014). Climate change discourses: How UK airlines
688 communicate their case to the public. *Journal of Sustainable Tourism*, *22*(5), 750-767.

689 Carlson, L., Grove, S. J., & Kangun, N. (1993). A content analysis of environmental
690 advertising claims: A matrix method approach. *Journal of advertising*, *22*(3), 27-39.

691 Chen, Y.S., & Chang, C.H. (2013) Greenwash and green trust: the mediation effects of green
692 consumer confusion and green perceived risk. *Journal of Business Ethics*, 114, 489-500.

693 Cohen, S. A., & Kantenbacher, J. (2020). Flying less: personal health and environmental co-
694 benefits. *Journal of Sustainable Tourism*, *28*(2), 361-376.

695 Courtis, J. K. (2004). Corporate report obfuscation: artefact or phenomenon?. *The British*
696 *Accounting Review*, *36*(3), 291-312.

Dhanda, K. K., & Hartman, L. P. (2011). The ethics of carbon neutrality: A critical examination of voluntary carbon offset providers. *Journal of Business Ethics*, *100*(1), 119-149.

Dhanda, K. K. (2014). The role of carbon offsets in achieving carbon neutrality. *International Journal of Contemporary Hospitality Management*.

Díaz, E., Martín-Consuegra, D., & Estelami, H. (2016). A persuasive-based latent class segmentation analysis of luxury brand websites. *Electronic Commerce Research*, *16*(3), 401-424.

Filieri, R., Yen, D.A. and Yu, Q. (2021) #ILoveLondon: an exploration of the declaration of love towards a destination on Instagram. *Tourism Management*, 85, 104291.

Forbes, L. C., & Jermier, J. M. (2012). The new corporate environmentalism and the symbolic management of organizational culture. In Bansal, P., Hoffman, A. (Eds.), *The Oxford handbook of business and the natural environment* (pp. 556-571). Oxford, England: Oxford University Press.

Gautami, A., Suganthi, L., & Sivakumaran, B. (2014) If You Blog, Will They Follow? Using Online Media to Set the Agenda for Consumer Concerns on "Greenwashed" Environmental Claims. *Journal of Advertising*, 43(2), 167-180.

Gillenwater, M., Broekhoff, D., Trexler, M., Hyman, J., & Fowler, R. (2007). Policing the voluntary carbon market. *Nature Climate Change*, *1*(711), 85-87.

Gössling, S., Scott, D., & Hall, C. M. (2015). Inter-market variability in CO2 emission-intensities in tourism: Implications for destination marketing and carbon management. *Tourism Management*, *46*, 203-212.

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

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

Gössling, S., Hanna, P., Higham, J., Cohen, S., & Hopkins, D. (2019). Can we fly less? Evaluating the 'necessity' of air travel. *Journal of Air Transport Management*, *81*, 101722.

Greene, W. H. (2014). Econometric analysis: International edition. *4th edition, New Jersey, USA: Pearson Publishing.*

Hall, D., Pavlenko, N., & Lutsey, N. (2018). Beyond road vehicles: survey of zero-emission technology options across the transport sector. *International Council on Clean Transportation Working Paper*, *11*.

Higham, J., Cohen, S. A., Cavaliere, C. T., Reis, A., & Finkler, W. (2016). Climate change, tourist air travel and radical emissions reduction. *Journal of Cleaner Production*, *111*, 336-347.

Higham, J.E.S., Cohen, S.A., Cavaliere, C.T., 2014. Climate change, discretionary air travel and the 'flyers' _dilemma'. J. Travel Res. 53 (4), 462–475.

Holsti, O. R. (1969). Content analysis for the social sciences and humanities. *Reading. MA: Addison-Wesley (content analysis)*.

IATA – International Air Transport Association. (2020). *IATA – Environment.* Retrieved May 28, 2020, from https://www.iata.org/en/programs/environment/

IATA. (2020). *COVID-19 Outlook for air travel in the next 5 years.* [PowerPoint slides]. https://www.iata.org/en/iata-repository/publications/economic-reports/covid-19-outlook-for-air-travel-in-the-next-5-years/

ICCT - International Council on Clean Transport. (2019). *CO2 emissions from commercial aviation, 2018.* Working paper International Council on Clean Transport, 2019-16.

Jose, A., & Lee, S. M. (2007). Environmental reporting of global corporations: A content analysis based on website disclosures. *Journal of Business Ethics*, *72*(4), 307-321.

Kim, Y., Yun, S., Lee, J., & Ko, E. (2016). How consumer knowledge shapes green consumption: An empirical study on voluntary carbon offsetting. *International Journal of Advertising*, *35*(1), 23-41.

Leamon, M. A., Rincon, E. J., Robillard, N. M., & Sutherland, J. J. (2019). Sustainable skies: how the airline industry is addressing climate change. *Journal of Strategic Innovation and Sustainability*, *14*(2), 85-112.

Lee, D. S., Fahey, D. W., Skowron, A., Allen, M. R., Burkhardt, U., Chen, Q., ... & Wilcox, L. J. (2021). The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018. *Atmospheric Environment*, *244*, 117834.

Lenzen, M., Sun, Y. Y., Faturay, F., Ting, Y. P., Geschke, A., & Malik, A. (2018). The carbon footprint of global tourism. *Nature Climate Change*, *8*(6), 522-528.

Le Quéré, C., Jackson, R. B., Jones, M. W., Smith, A. J., Abernethy, S., Andrew, R. M., ... & Peters, G. P. (2020). Temporary reduction in daily global CO 2 emissions during the COVID-19 forced confinement. *Nature Climate Change*, *10*(7), 647-653.

Li, J., Pearce, P.L. & Low, D. (2018). Media representation of digital-free tourism: A critical discourse analysis. *Tourism Management*, 69, 317-329.

Liu, L., Chen, R., & He, F. (2015). How to promote purchase of carbon offset products: Labeling vs. calculation?. *Journal of Business Research*, *68*(5), 942-948.

Liu, T., Wang, Q., & Su, B. (2016). A review of carbon labeling: Standards, implementation, and impact. *Renewable and Sustainable Energy Reviews*, *53*, 68-79.

Lovell, H. C. (2010). Governing the carbon offset market. *Wiley interdisciplinary reviews: climate change*, *1*(3), 353-362.

MacKerron, G. J., Egerton, C., Gaskell, C., Parpia, A., & Mourato, S. (2009). Willingness to pay for carbon offset certification and co-benefits among (high-) flying young adults in the UK. *Energy policy*, *37*(4), 1372-1381.

Mair, J. (2011). Exploring air travellers' voluntary carbon-offsetting behaviour. *Journal of Sustainable Tourism*, *19*(2), 215-230.

Mayer, R., Ryley, T., & Gillingwater, D. (2015). Eco-positioning of airlines: Perception versus actual performance. *Journal of Air Transport Management*, *44*, 82-89.

Miller, D. T., & Effron, D. A. (2010). Psychological license: When it is needed and how it functions. In *Advances in experimental social psychology* (Vol. 43, pp. 115-155). Academic Press.

Peeters, P., Bouwer, J., Bongaerts, R., & Eijgelaar, E. (2019). Airlines and corporate responsibility: Issues and challenges. *Corporate Sustainability and Responsibility in Tourism*, 163-180.

Polonsky, M. J., Grau, S. L., & Garma, R. (2010). The new greenwash?: Potential marketing problems with carbon offsets. *International Journal of Business Studies: A Publication of the Faculty of Business Administration, Edith Cowan University*, *18*(1), 49-54.

Polonsky, M., & Garma, R. (2008, January). Are carbon offsets potentially the new" greenwash?". In *ANZMAC 2008: Australian and New Zealand Marketing Academy Conference 2008: Marketing: Shifting the Focus from Mainstream to Offbeat*. Promaco Conventions Pty Ltd.

Ritchie, B. W., Sie, L., Gössling, S., & Dwyer, L. (2020). Effects of climate change policies on aviation carbon offsetting: a three-year panel study. *Journal of Sustainable Tourism*, *28*(2), 337-360.

Ritchie, B. W., Kemperman, A., & Dolnicar, S. (2021). Which types of product attributes lead to aviation voluntary carbon offsetting among air passengers?. *Tourism Management*, *85*, 104276.

Scheelhaase, J., Maertens, S., Grimme, W., & Jung, M. (2018). EU ETS versus CORSIA–A critical assessment of two approaches to limit air transport's CO2 emissions by market-based measures. *Journal of Air Transport Management*, *67*, 55-62.

Scott, D., Gössling, S., Hall, C. M., & Peeters, P. (2016). Can tourism be part of the decarbonized global economy? The costs and risks of alternate carbon reduction policy pathways. *Journal of Sustainable Tourism*, *24*(1), 52-72.

Schmuck, D., Jörg, M., & Brigitte, N. (2018). Misleading consumers with green advertising? An affect–reason–involvement account of greenwashing effects in environmental advertising. *Journal of Advertising*, 47(2), 127-145.

Segerstedt, A., & Grote, U. (2016). Increasing adoption of voluntary carbon offsets among tourists. *Journal of Sustainable Tourism*, *24*(11), 1541-1554.

Siano, A., Vollero, A., Conte, F. & Amabile, S. (2017). “More than words”: Expanding the taxonomy of greenwashing after the Volkswagen scandal. *Journal of Business Research*, 71, 27-37.

Smith, K. (2007). *The carbon neutral myth: offset indulgences for your climate sins* (pp. 8-10). Amsterdam: Carbon Trade Watch.

812 Smith, A. E., & Humphreys, M. S. (2006) Evaluation of unsupervised semantic mapping of
813 natural language with Leximancer concept mapping. *Behavior Research Methods*, 38(2),
814 262-279.

815 Sotiriadou, P., Brouwers, J., & Tuan-Anh, L. (2014) Choosing a qualitative data analysis tool:
816 a comparison of NVivo and Leximancer, *Annals of Leisure Research*, 17(2), 218-234.

817 Szabo, S. & Webster, J. (2021) Perceived greenwashing: the effects of green marketing on
818 environmental and product perceptions. *Journal of Business Ethics*, 171, 719-739.

819 Tseng, C., Wu, B., Morrison, A.M., Zhang, J. & Chen, Y. (2015). Travel blogs on China as a
820 destination image formation agent: A qualitative analysis using Leximancer. *Tourism*
821 *Management*, 46, 347-358.

822 UK Competition and Market Authority (2021) Global sweep finds 40% of firms' green claims
823 could be misleading. Retrieved January 28, 2021, from
824 https://www.gov.uk/government/news/global-sweep-finds-40-of-firms-green-claims-
825 could-be-misleading

826 UL LLC. (2020). *Sins of Greenwashing | UL.* Retrieved May 29, 2020, from
827 https://www.ul.com/insights/sins-greenwashing

828 United Nations. (2020). *World economic situation prospects.* New York, USA: United
829 Nations.

830 Wang, H., Baolong M., & Rubing, B. (2019). The spillover effect of greenwashing
831 behaviours: an experimental approach. *Marketing Intelligence & Planning*, 38(3), 283-295.

832 Zeppel, H., & Beaumont, N. (2013). Assessing motivations for carbon offsetting by
833 environmentally certified tourism enterprises. *Anatolia*, *24*(3), 297-318.

834 Zhang, B., Ritchie, B., Mair, J., & Driml, S. (2019a). Can message framings influence air
835 passengers' perceived credibility of aviation voluntary carbon offsetting
836 messages?. *Journal of Sustainable Tourism*, *27*(9), 1416-1437.

837 Zhang, B., Ritchie, B., Mair, J., & Driml, S. (2019b). Is the airline trustworthy? The impact of
838 source credibility on voluntary carbon offsetting. *Journal of Travel Research*, *58*(5), 715-
839 731.