



Voluntary carbon offsetting among consumers: Part of environmentally sustainable lifestyles or a license to pollute?

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ABSTRACT

Voluntary carbon offsetting (VCO), i.e., financially compensating climate emissions caused by one's actions has provoked critical debate in recent years. The purpose of this study was to examine VCO: do citizens interpret it as part of environmentally sustainable lifestyles or a "license to pollute"? A sample of the Finnish population (N = 998) completed an online survey in June–July 2021. The respondents were asked about the frequency of having engaged in three different VCO practices during the preceding 2–3 years: offsetting emissions from one's air travel, favouring products with a pre-offset carbon footprint, and offsetting personal carbon footprint, as well as a wide range of other environmentally significant practices. The results of hierarchical logistic regression analyses revealed that past engagement in VCO was mostly associated with sustainable consumption practices that aim to reduce emissions. The only exception was past engagement in VCO associated with flying. Based on the results, we conclude that instead of consumers taking advantage of compensation as a "license to pollute", it may also be an element of lifestyles striving for environmentally sustainability and can thus be interpreted as part of lifestyle political consumerism in many spheres of consumption.

1. Introduction

1.1. Voluntary carbon offsetting as a means to reduce carbon emissions

Due to the acceleration of climate change, there is an urgent need to reduce greenhouse gas emissions (GHG) caused by unsustainable production and consumption practices. It has been recommended that consumers should primarily try to avoid and reduce their emissions and offset those emissions that they cannot avoid (Bumpus and Liverman, 2008). As a response to this need, a voluntary carbon offsetting (VCO¹) market has emerged. It is based on a system in which the production of greenhouse gas emissions in one place is offset by reducing emissions or sequestering carbon from the atmosphere elsewhere, and the process is financed through a voluntary market of carbon credits. Geographically, most voluntary carbon reduction/sequestering projects have been in the Global South and the USA (Donofrio et al., 2022). In order to fill this gap, we studied the behaviours of consumers in Finland,

a wealthy Nordic welfare state. The Finnish offset projects have often focused on forest management practices such as afforestation and fertilizing forests as well as rewetting previously drained organic soils (Finnwatch, 2021). In Finland, consumers have in recent years been able to offset emissions from some specific sources (e.g., from flying), to buy products or services the carbon footprint of which has been offset by the selling company, or to make regular payments to carbon offsetting organisations to offset the emissions caused by one's lifestyle.

Simultaneously with consumers' increasing opportunities and companies' increasing interest to offset at least part of their emissions, media attention to the phenomenon has intensified. In Finland, the media has often presented VCO as complex and difficult to understand and revealed uncertainties and discrepancies in the actual environmental impacts of offsetting projects (Frilander, 2021; Hukkanen and Kanerva, 2020; Pennanen, 2021). It has been asked whether offsetting is 'indulgence trade' or a 'license to pollute', i.e., a way for both industries and consumers to buy a clear conscience when causing climate emissions

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¹ We use the acronym VCO for voluntary carbon offsetting, in accordance with e.g., Denton et al. (2020).

(Dalsgaard, 2022; Reimers et al., 2021). In general, consumers' knowledge of and trust in carbon offsetting companies have been found to increase their engagement with VCO (Denton et al., 2020). However, consumers appear to have a low level of knowledge of VCO and to perceive it as complicated (Haug and Hassinggaard, 2022) and untrustworthy (Karhunmaa et al., 2023).

Many studies on consumers' engagement in VCO have focused on their willingness to pay (WTP) for VCO of air travel. For example, there is evidence that the highest WTP for offsetting emissions of air travel can be found among young, high-income, and highly educated air travellers concerned about climate change (Cordes et al., 2024). A study of air travel offsetting conducted in the UK and Australia found that offsetters were more likely to be men, younger, and slightly more educated than non-offsetters (Mair, 2011). Another study conducted in Germany found similarly that WTP for offsets was associated with higher income, younger age, and stronger environmental and social preferences, and believing that offsetting is effective in protecting the climate (Schwirplies et al., 2019). In general, there is still little evidence on the extent of consumer engagement in different kinds of VCOs apart from offsetting air travel emissions.

1.2. Theoretical background: voluntary carbon offsetting as political consumerism

Theoretically, we explore VCO as a form of political consumerism. Consumers can influence society as political consumers through their purchasing decisions on the market. In this way, consumption becomes a political mode of action, a grass-root level complement, or even an alternative to more conventional political participation such as voting (Micheletti, 2003; Boström et al., 2019a). Different modes of political consumerism have been identified (Stolle and Micheletti, 2013; Boström et al., 2019b). Boycotting and buycotting refer to avoiding or favouring certain products and services due to ethical, environmental or political reasons. We suggest that VCO can be conceptualized as *buycotting*, since it is about favouring products and services the carbon emissions of which have been offset by the selling company or can be offset by the consumer. Buycotting activities have been associated with the use of cooperative strategies and building stakeholder partnerships with private and public organisations in encouraging people to switch to buying more ethical or ecological products (Boström et al., 2019b). Boycotting is focused on 'punishing' companies or countries with objectionable action, whereas buycotting 'rewards' those with favourable action (Copeland, 2014; de Moor and Balsiger, 2019).

In addition, VCO can be seen as a part of *lifestyle political consumerism* when it practiced as a part of a wider network of ecologically, ethically, and socially responsible patterns of consumption. Lifestyle political consumerism indicates wider considerations and concerns of the ecological, ethical, and social implications of lifestyles. It can incorporate various sustainable practices of consumption, and it can develop into a deep commitment to a particular way of life, such as practicing voluntary simplicity (Boström et al., 2019b).

According to a meta-analysis of 66 studies on boycotting and/or buycotting in European countries, the U.S., Canada and Brazil (Copeland and Boulianne, 2022), political consumerism is associated with being middle-aged, having a high education level, high interest in politics, liberal or leftist ideology, and low trust toward political institutions (see also Berlin, 2011; Micheletti and Stolle, 2012; Niva and Jallinoja, 2018; Sandovici and Davis, 2010). Politically left-leaning individuals, in turn, tend to report higher climate concern (McCright et al., 2016), although the strength of this relationship may vary across countries and individuals' climate change beliefs (Gregersen et al., 2020). It has also been found that those who live in urban environments (Neilson and Paxton, 2010; Zhang, 2015) and who donate for charity (Baumann et al., 2015) are more active political consumers. Consumers' participation in boycotting and/or buycotting is more widespread in Northern than Southern Europe, including Finland (de Moor and Balsiger, 2019;

Micheletti and Stolle, 2012). A Finnish study showed that women, the highly educated, those with a leftist political orientation, donating for charity, believing in citizens' possibilities to make an impact in society through their consumption choices, and valuing the ethicality of food were more likely to be political food consumers than others (Niva and Jallinoja, 2018).

As part of political consumerism, we wanted to explore the prevalence of VCO as a "license to pollute". Moral licensing is a phenomenon where moral behaviour is used as a justification for subsequent violations of social norms (Rotella and Barclay, 2020). In the context of pro-environmental behaviour, moral licensing has been operationalized as negative spillover where engagement in environmentally sustainable behaviours is associated with subsequent engagement with environmentally unsustainable behaviours (Truelove et al., 2014). For example, the purchase of VCO for electricity may sometimes increase electricity use among consumers, resulting in additional carbon emissions (Jacobsen et al., 2012).

We assume that lifestyle political consumerism can be measured by different environmentally sustainable consumption practices, as well as the endorsement of high climate concern. In this study we measure the prevalence of 'licence to pollute' as a negative spillover between VCO and environmentally unsustainable practices (e.g., Jacobsen et al., 2012; Truelove et al., 2014). More specifically, we analyse the associations of VCO with environmentally sustainable and non-sustainable consumption practices. These patterns are interpreted as providing insight of how VCO engagement may be embedded within broader lifestyle orientations. In the context of political consumerism, it is also relevant to understand what kind of consumers voluntary carbon offsetters are: what are their sociodemographic backgrounds, are they concerned about climate change, and is offsetting associated with participation in climate-relevant societal affairs? To our knowledge, no studies have been conducted on the prevalence of VCO among consumers, the characteristics of offsetters and the ways in which engaging in offsetting is associated with other environmentally sustainable consumption practices. More specifically, we aim to answer the following research questions.

RQ1. To what extent do Finnish consumers report having engaged in different kinds of VCO: offsetting the emissions from one's flights, favouring pre-offset products, and offsetting personal carbon footprint?

RQ2. How are environmentally sustainable and unsustainable consumption practices associated with different forms of VCO?

RQ3. How are consumers' socioeconomic characteristics, attitudes, and participation in climate-relevant societal affairs associated with engagement with different forms of VCO?

2. Material & methods

2.1. Data sample

The data were collected as a part of larger online survey regarding VCO and environmentally sustainable lifestyles in Finland in June–July 2021. The data were conducted anonymously by a consumer research company Bilendi. The company is specialised in collecting survey data, using a panel the members of which have given their consent to receive email invitations to surveys on various topics. All participants provided informed consent and participated in the study voluntarily. The sample was formed using sampling quotas that represented the 18–74-year-old population living in mainland Finland. The invitation to participate was sent to 6667 panel members, of whom 1000 responded, corresponding to a 15% response rate. Since only 0.2% of the respondents selected the gender option 'other', statistical analyses could not be carried out for this group. Therefore, these respondents were removed from the dataset resulting in the final $n = 998$.

The sample represented relatively well the Finnish 18–74-year-old

population in terms of age distribution and gender (Table 1). However, the majority (91%) of the respondents had secondary or tertiary education, making the education level slightly higher than in the Finnish population. In addition, the income of respondents' households was on average higher than in the population. In total, 79% of the respondents lived in urban areas and cities. Most lived in single households or households with two or more adults.

2.2. Questionnaire

The questionnaire was originally in Finnish and has been translated by the authors. In the beginning of the questionnaire, the following definition of VCO was presented to the participants: 'Voluntary carbon offsetting is activity that allows consumers or companies to offset their own carbon emissions by reducing or sequestering an amount equivalent to their own emissions somewhere else. The purpose of offsetting emissions is to enable against payment, for example, the compensation of greenhouse gas emissions caused by travel or of the production of a purchased product.' Moreover, before asking the respondents whether they had offset their own emissions it was specified that 'Consumers can offset emissions through voluntary emissions compensation, for example by purchasing climate units from voluntary carbon markets.'

Sociodemographic background measures. The following background variables were included: gender, age (recoded as 1 = 18–34, 2 = 35–54, and 3 = 55–74 years old), the highest educational degree completed (1 = basic education, 2 = secondary education, 3 = tertiary education), household type (recoded as 1 = living alone, 2 = adult household without children, 3 = household with children, and 4 = other), residential area type (recoded as 0 = rural centres and areas, 1 = cities and

Table 1

Socio-demographic profiles of the final data sample (n = 998) and the Finnish population in 2021 (Statistics Finland, 2021a, 2021b, 2025).

	Survey sample (%)	Finnish population (%)
Age group		
18–34 years	28.9	28.8 ^a
35–54 years	34.8	35.0 ^a
55–74 years	36.3	36.2 ^a
Gender		
men	50.3	50.3 ^a
women	49.7	49.7 ^a
Level of education		
basic education ^a	8.8/7.9 ^d	17.2 ^c
secondary education ^b	52.9/53.0 ^d	44.9 ^c
tertiary education ^c	38.3/39.1 ^d	36.7 ^c
Residential area type		
rural centres and areas	21.2	26.8
cities and areas close to cities	78.8	73.2
Household type		
single household	34.6	26.6 ^f
household with two or more adults	32.8	39.1 ^g
household with children under 18 years of age	26.3	30.2 ^h
other	6.4	4.1 ^b
Annual household pre-tax income		
less than 20,000€	16.9	18.6 ^c
between 20,000€ and 39,999€	24.0	27.9 ^c
between 40,000€ and 69,999€	23.8	26.1 ^c
between 70,000€ and 99,999€	12.6	14.6 ^c
more than 100,000€	6.8	12.9 ^c
I do not want to say	16.0	

^a Comprehensive school.

^b Upper secondary school or vocational education.

^c University or university of applied sciences.

^d In the whole sample/among the 20–74-year-olds in the sample.

^e Among the 20–74-year-old population.

^f Statistics Finland (2021a).

^g Statistics Finland (2021b).

^h Statistics Finland, personal communication, June 26, 2025).

areas close to cities), political orientation (scale: 0 = left, 10 = right), and annual pre-tax income per consumption unit. The annual income per consumption unit was formed by first calculating the weighted sum of the members of the household. Following Statistics Finland (2023), the first adult (aged 18 or over) living in the household received the weight 1.0 and the others aged 18 or over the weight 0.7. Each household member under the age of 18 received the weight 0.5. The annual household income reported by the respondent was recoded as 100 = under 15,000€, 200 = 15,000 – 19,999€, 300 = 20,000€ – 39,999€, 400 = 40,000 – 69,999€, 500 = 70,000€ – 99,999€, 600 = 100,000 – 119,999€, 700 = 120,000 – 149,999 €, 800 = over 150,000€ and then divided by the sum of the weights of the household members. Responses of 'I do not want to say' were treated as missing and excluded from the analysis.

The respondents were also asked whether they owned forest (0 = no, 1 = yes). There are about 600,000 private forest owners in Finland (ca. 10% of the population) (Natural Resources Institute Finland, 2019). We included this question because forests are relevant for the Finnish VCO market as they are often used in Finnish VCO projects (Laine et al., 2021). (For descriptions of the mentioned variables, their measurements, and coding, see Table S1 in Supplementary material).

Past engagement in VCO activities. Self-reported engagement in VCO was inquired with the following question: 'How often have you done the following things in the last 2–3 years on average?', with four response options ('not at all'; 'occasionally'; 'often or regularly'; 'always or almost always'). The participants were requested to indicate their engagement in three forms of VCO, each measured with one question: 1) offsetting emissions from one's flights, 2) favouring products the climate emissions of which have been offset by the manufacturing company, and 3) offsetting personal carbon footprint.

Environmentally significant consumption practices. The survey included a wide range of questions of environmentally significant activities in various realms of consumption (Stern, 2000) which had either very low (such as eating plant-based protein) or very high negative environmental impact (such as eating red meat or cheese) (e.g. Poore and Nemesek, 2018; Tilman and Clark, 2014; Scarborough et al., 2014). The respondents were asked how often they had carried out these activities in preceding 2–3 years on average, with four response options: 'not at all', 'occasionally', 'often or regularly', and 'always or almost always'.

Participating in climate-relevant societal affairs. The survey also included questions of voting for a candidate who is committed to climate action and supporting climate actions financially (by other means than offsetting). The response options for these were the same as above ('not at all', 'occasionally', 'often or regularly', and 'always or almost always'). The measured environmentally significant activities and participating in climate-relevant societal affairs and the response distributions are presented in Fig. 1.

Attitudes. Attitudinal questions included a question of political orientation and a question of climate concern. Political orientation was measured with the question "In politics, people sometimes talk about the left and the right. Where would you place yourself on a scale from zero to ten, where zero represents the left and ten the right?". Climate concern was measured with the question "How worried are you about climate change?" and measured on a scale from 1 to 5: 1 = 'not worried at all', 2 = 'not very worried' 3 = 'somewhat worried', 4 = 'very worried', 5 = 'extremely worried'.

2.3. Analysis

Data analyses were conducted using IBM SPSS version 28.0. First, some variables were transformed to make them suitable for binary logistic regression. Variables measuring VCO activities and environmentally significant practices were transformed into binary variables due to the highly skewed distribution of the responses, resulting in sparse data and empty cells in several category combinations in ordinal models

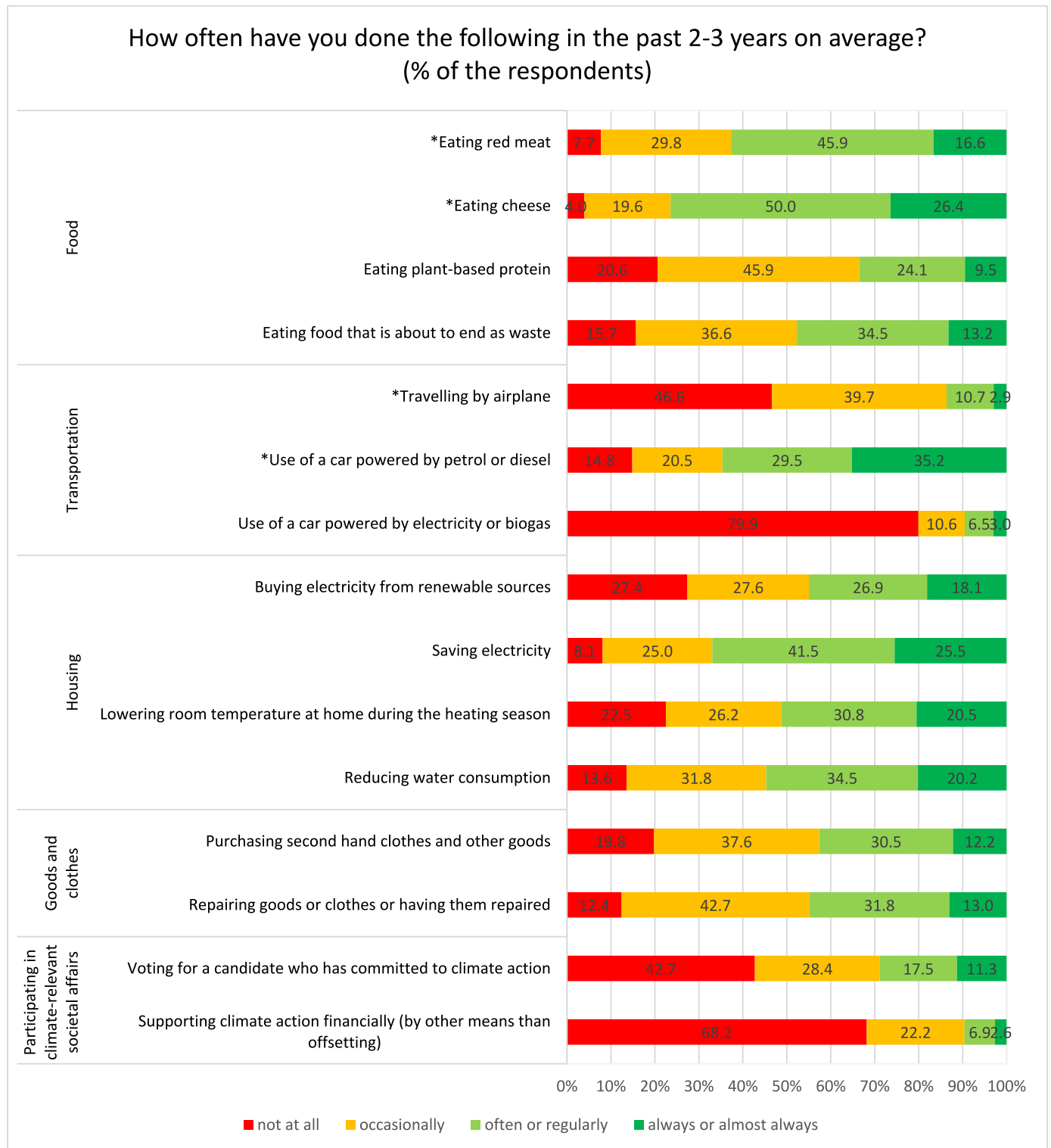


Fig. 1. Self-reported engagement in various environmentally significant consumption practices and participating in climate-relevant societal affairs among the respondents (%; n = 998). Practices with a high negative environmental impact marked with an asterisk (*).

(recoded as 0 = 'not at all' and 1 = 'at least occasionally').

We also conducted an exploratory factor analysis (maximum likelihood, Varimax rotation) to combine environmentally significant behaviours into fewer variables. The adequacy of the data for factor analysis was confirmed (KMO = 0.812; Bartlett's test of sphericity: $\chi^2(105) = 3309.982$, $p < .001$). Reducing water consumption, saving electricity, and lowering indoor temperature loaded clearly on a single

factor (factor loadings = 0.69–0.81) and they were combined into a mean variable 'household energy-saving behaviours' (Cronbach's alpha = 0.822). Other behaviours showed weaker loadings and were therefore analysed separately (Table S2 in Supplementary material).

Bivariate correlations of independent variables ranged from low to moderate ($r = 0.30 - 0.47$), which did not indicate a strong multicollinearity. All VIF values were below the generally accepted threshold

of 10 (Hair et al., 2010), indicating no serious multicollinearity. Most predictors had VIF values between 1.073 and 1.999, indicating low intercorrelation (Tables S3 and S4).

Three hierarchical logistic regression models were created to examine the association between the likelihood of VCO and socio-demographic variables (gender, age, educational level, household type, residential area type, income, and being a forest owner), attitudes (political orientation and climate concern) and different environmentally significant consumption practices. The variables were entered in three blocks: sociodemographic variables in the first step, attitudes (political orientation and climate concern) in the second step, and environmentally significant consumption practices in the third step. All models used an identical set of independent variables and differed only with respect to the dependent variable. Furthermore, the model estimating offsetting for own flight emissions was estimated on a subsample consisting of respondents who had reported flying at least occasionally during the previous 2–3 years. The Hosmer and Lemeshow goodness-of-fit tests ($p > .05$) (Table 2) indicated that all three models provided an adequate fit to the data.

3. Results

3.1. To what extent do Finnish consumers engage in different kinds of VCO practices?

Of the three measured VCO practices, choosing products with a pre-offset carbon footprint was the most common means of VCO among the respondents, with 58% having done that at least occasionally in the preceding 2–3 years on average (Fig. 2). Offsetting personal carbon footprint was the second most common VCO practice (44% having done that at least occasionally). Offsetting emissions from flying was the least common VCO practice (23% of the total sample and 41% of the subgroup who had flown during the period). In addition, different forms of VCO correlated with each other positively ($r = 0.44 - 0.61$) (see Table S3 in Supplementary material).

3.2. How are environmentally significant consumption practices associated with voluntary carbon offsetting?

3.2.1. Offsetting emissions from flying

Considering that only those who take flights do offset their emissions from flying, we analysed only the subsample of respondents who reported having flown at least occasionally during the last 2–3 years ($n = 533$). The model on offsetting one's flight emissions including socio-demographics, attitudes and behaviours explained 44.6% (Nagelkerke R^2) (Table 2) of the variance and correctly classified 77.7% of the cases.

The results of the final logistic regression models are presented in Table 3. When the model included only sociodemographic variables, two variables were statistically significant: individuals aged 35–54 were

less likely to offset than those aged 18–34, and those with the highest level of education were less likely to offset flight emissions than those with the lowest level. Both age and education remained statistically significant when attitudinal variables (political orientation and climate concern) were added in Step 2.

With the addition of behavioural variables in Step 3, higher education remained negatively associated with offsetting flights. Behavioural variables provided the largest improvement in model fit and explanatory power, as evidenced by the substantial increase in Nagelkerke R^2 and the change in model chi-square at Step 3. The likelihood of offsetting flight emissions was associated also with increased use of a car powered by electricity or biogas. Financial support for climate actions was also associated with a considerably higher likelihood of offsetting emissions from flying.

3.2.2. Favouring pre-offset products

The logistic regression on favouring pre-offset products model explained 43% (Nagelkerke R^2) of the variance and correctly classified 77.3% of the cases. In Step 1, gender became the only significant factor with women having higher odds of favouring pre-offset products as compared to men. In Step 2, gender remained significant while left-wing political orientation and climate concern were also significantly associated with favouring pre-offset products.

Step 3 results showed that after adding behavioural variables gender remained statistically significant with broadly similar effect size. In addition, the oldest age group (55–74-year-olds and the highest level of education became significant. Women, those without tertiary education, and those politically oriented towards left were more likely than others to favour pre-offset products. Both political orientation and climate concern remained significant.

Behavioural variables contributed most strongly to the explanatory power of the model. Favouring pre-offset products was linked to several pro-environmental behaviours, including consuming plant-based protein, engaging in purchasing electricity from renewable sources, household energy-saving behaviours, and repairing or having goods or clothes repaired. Apart from this, those travelling by plane were more likely to favour pre-offset products. Voting for a candidate committed to climate actions and financially supporting climate actions were associated with increased likelihood of favouring pre-offset products.

3.2.3. Offsetting personal carbon footprint

The logistic regression model on offsetting personal carbon footprint explained 33.8% (Nagelkerke R^2) of the variance and correctly classified 71.1% of the cases. In Step 1, the only statistically significant variables were the age group of 35–55-year-olds and the highest education. These variables remained significant in Step 2 where climate concern was also associated with increased offsetting of personal carbon footprint.

Consistent with the previous models, behavioural variables accounted for the largest improvement in model fit and explanatory power. In

Table 2
Model fit statistics for three logistic regression models (Steps 1–3).

Model	Step	–2LL	$\Delta\chi^2$	df	p	Nagelkerke R^2	Hosmer–Lemeshow test
Model 1 - Offsetting emissions from flying	1	688.476	33.396	11	<0.001	0.082	7.775 (p = .456)
	2	669.7	18.776	2	<0.001	0.126	11.831 (p = .159)
	3	507.804	161.896	12	<0.001	0.446	15.305 (p = .053)
Model 2 - Favouring pre-offset products	1	1328.312	31.97	11	0.001	0.042	7.960 (p = .437)
	2	1240.376	87.936	2	<0.001	0.152	11.471 (p = .176)
	3	975.114	265.262	13	<0.001	0.430	8.364 (p = .399)
Model 3 - Offsetting personal carbon footprint	1	1329.846	40.162	11	<0.001	0.053	5.942 (p = .654)
	2	1291.093	38.753	2	<0.001	0.102	5.676 (p = .684)
	3	1080.097	210.996	13	<0.001	0.338	8.042 (p = .429)

–2LL = –2 log likelihood; $\Delta\chi^2$ = change in chi-square; df = degrees of freedom.

Step 1 includes sociodemographic variables; Step 2 adds attitudes; and Step 3 adds environmentally significant consumption practices. Nagelkerke R^2 is a pseudo- R^2 measure of explained variance. The Hosmer–Lemeshow χ^2 test is used to assess the goodness of fit of a logistic regression model; non-significant p-values indicate an acceptable model fit.

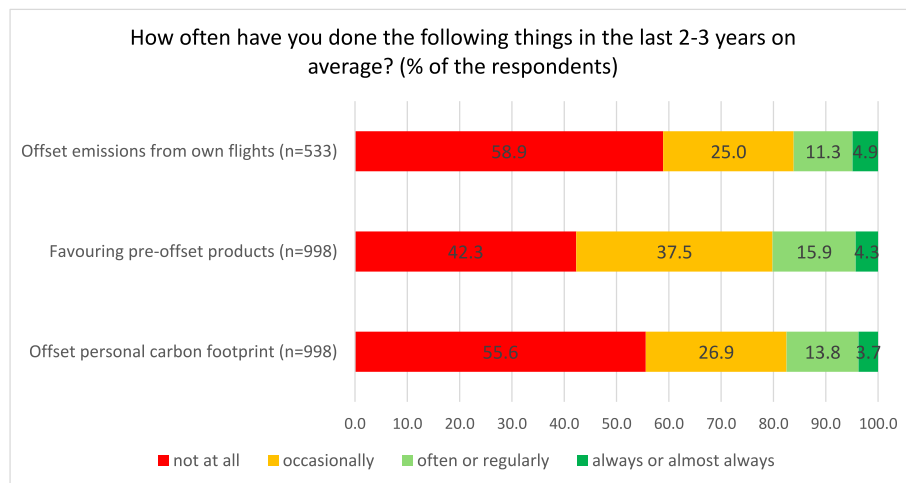


Fig. 2. Self-reported engagement in three different VCO practices among the respondents (%; $n = 998$; $n = 533$ for those who reported flying at least occasionally in the past 2–3 years).

Table 3

The logistic regression models for 1) offsetting emissions from flying (Model 1), 2) favouring pre-offset products (Model 2), and 3) offsetting personal carbon footprint (Model 3). The full model including the socio-demographics, attitudes and behaviours as independent variables (Step 3). Coefficients, standard errors, and adjusted odds ratios. Practices with a high negative environmental impact are marked with an asterisk.

	Model 1: Offsetting emissions from personal air travel (among those who flew at least occasionally)			Model 2: Favoring products with pre- offset carbon footprints			Model 3: Offsetting personal carbon footprint		
	B	S.E.	Exp(B)	B	S.E.	Exp(B)	B	S.E.	Exp(B)
<i>Sociodemographic background</i>									
Gender (ref.: man)	−0.009	0.24	0.991	0.525	0.172	1.691**	0.193	0.16	1.213
Age group 35–54-year-olds (ref.: 18–34-year-olds)	−0.235	0.294	0.791	0.396	0.21	1.486	−0.248	0.196	0.78
Age group 55–74-year-olds (ref.: 18–34-year-olds)	0.022	0.308	1.022	0.543	0.224	1.721*	0.26	0.207	1.297
Education: secondary (ref.: Basic)	−0.296	0.465	0.744	0.055	0.305	1.057	−0.386	0.288	0.68
Education: tertiary (ref.: Basic)	−1.148	0.484	0.317*	−0.699	0.325	0.497*	−1.078	0.307	0.340***
Forest owner (ref.: "No")	0.383	0.314	1.466	0.446	0.231	1.562	0.322	0.223	1.381
Household type: adult household without children (ref.: Living alone)	0.176	0.299	1.192	−0.156	0.212	0.855	−0.152	0.196	0.859
Household type: adult household with under-aged children (ref.: Living alone)	0.558	0.371	1.747	−0.379	0.256	0.684	−0.028	0.237	0.972
Household type: other (ref.: Living alone)	0.584	0.492	1.793	−0.248	0.374	0.781	−0.44	0.355	0.644
Residential area type: cities and areas close to cities (ref.: Rural centres and areas)	0.077	0.297	1.08	0.1	0.201	1.105	0.177	0.189	1.194
Annual income per consumption unit	0.001	0.001	1.001	−0.001	0.001	0.999	−0.001	0.001	0.999
<i>Attitudes</i>									
Right-wing political orientation	−0.011	0.049	0.989	−0.073	0.037	0.929*	−0.011	0.034	0.99
Climate concern	0.214	0.122	1.239	0.292	0.088	1.339***	0.101	0.083	1.107
<i>Food</i>									
*Consuming red meat (ref.: Never)	0.196	0.479	1.217	−0.022	0.337	0.978	0.211	0.302	1.235
Consuming cheese (ref.: Never)	0.26	0.599	1.297	−0.371	0.456	0.69	−1.041	0.433	0.353
Consuming plant-based proteins (ref.: Never)	−0.009	0.324	0.991	0.637	0.213	1.891**	0.392	0.212	1.48
Eating food that goes to waste (ref.: Never)	0.516	0.364	1.676	0.176	0.228	1.192	0.223	0.233	1.249
<i>Transportation</i>									
*Travelling by plane (ref.: Never)				0.489	0.172	1.630**	0.266	0.16	1.304
Using a car powered by petrol or diesel (ref.: Never)	−0.122	0.384	0.885	0.046	0.244	1.047	−0.454	0.225	0.635
Using a car powered by electricity or biogas (ref.: Never)	0.811	0.273	2.251**	0.335	0.233	1.398	0.718	0.211	2.051***
<i>Housing</i>									
Purchasing electricity from renewable sources (ref.: Never)	0.336	0.297	1.4	0.771	0.191	2.163***	0.443	0.194	1.558*
Household energy-saving behaviours (mean variable)	0.213	0.167	1.237	0.483	0.108	1.621***	0.445	0.103	1.561***
<i>Goods and clothes</i>									
Purchasing goods or clothing second-hand (ref.: Never)	0.305	0.316	1.357	0.235	0.219	1.265	0.793	0.221	2.210***
Repairing or having goods or clothing repaired (ref.: Never)	0.417	0.413	1.518	0.547	0.263	1.729*	−0.106	0.258	0.899
<i>Participating in climate-relevant societal affairs</i>									
Voting for a candidate committed to climate actions (ref.: Never)	0.271	0.281	1.311	0.669	0.179	1.952***	0.458	0.178	1.581*
Financially supporting climate action (excluding carbon offsets) (ref.: Never)	1.918	0.271	6.810***	1.196	0.217	3.306***	0.962	0.184	2.617***
Constant	−4.383	1.147		−4.447	0.786		−2.31	0.724	

*** $p < .001$; ** $p < .01$; * $p < .05$.

Step 3, higher education remained statistically significant and negatively associated, indicating that individuals with higher education were

less likely to offset their personal carbon footprint. In terms of practices related to food, not consuming cheese was associated with increased

likelihood of offsetting personal carbon footprint. Moreover, those using a car powered by electricity or biogas but not petrol or diesel, engaging in purchasing of electricity from renewable sources and energy-saving behaviours, purchasing goods or clothes second hand, and participating in climate-relevant societal affairs by voting or supporting climate actions financially were more likely to offset their own carbon footprint.

4. Discussion and conclusions

In this study we examined three ways of voluntary carbon offsetting (VCO) among Finnish consumers, revealing insights into the prevalence and determinants of these practices. The findings underscore the complexity of consumer engagement in carbon offsetting, highlighting its relationship with sociodemographic factors and lifestyle political consumerism, which we operationalized as participating in environmentally sustainable consumption practices.

The results show, first, that a significant share of the respondents reported having offset their emissions one way or another at least occasionally. More than half (58%) of the respondents reported favouring pre-offset products and 44% offsetting their personal carbon footprint. Among respondents who had flown during the last 2–3 years, 41% reported having offset their emissions from flying at least occasionally. The results thus suggest that a substantial share of consumers prefer products that integrate VCO into their value proposition. While this seems promising, recent legislation has changed the situation. To reduce vague or potentially misleading environmental claims made to consumers, European Union has forbidden the use of such terms as “carbon neutral” on products or services, when this follows from offsetting (European Parliament and the Council, 2024). Therefore, this previously rather popular practice of buying pre-offset products becomes impossible in Finland. Whether this change increases or decreases consumers’ trust towards the VCO is an interesting question for further studies, but certainly it leaves them with fewer opportunities to participate in offsetting. Another interesting question is whether these declining opportunities for offsetting will lead to increased engagement in other forms of climate action and environmentally responsible consumption.

Second, the results suggest that VCO is associated with various efforts to consume in a more environmentally sustainable way in several realms: food, transportation, housing, goods and clothes, as well as engaging in climate-relevant societal affairs. All three VCO practices were positively associated with low energy housing, financially supporting climate action, and voting for a candidate committed to climate actions. While offsetting emissions from flying was associated only with driving a car powered by electricity or biogas and supporting climate action financially, purchasing pre-offset products and offsetting personal carbon footprint were associated with a wider set of sustainable lifestyle practices, including environmentally sustainable eating, transportation, housing, purchasing goods and clothes as well as engaging in climate-relevant societal affairs. As flying is among the most carbon-intensive forms of consumption, the findings leave room for the interpretation that offsetting may, at least in some cases, serve as compensating for a more resource-intensive lifestyle. However, also the explanatory variables for favouring pre-offset products and offsetting one's personal carbon footprint varied. The variety in the explanatory variables in the three models suggests that different segments of environmentally sustainable consumers tend to use different ways to offset. Despite this variation, the results indicate that in general, carbon offsetting is positively associated with various kinds of environmentally sustainable consumption practices and can thus be seen as part of lifestyle political consumerism in a wider sense. People are thus not engaged in carbon offsetting just to offset the emissions they cause, but that offsetting forms a part of a more general effort to reduce the carbon footprint of modern lifestyles. Thus, although carbon offsetting as a phenomenon can be conceptualized as a form of ‘buycotting’, for carbon offsetters it seems to represent an option that supports their other

pursuits for more environmentally benign consumption patterns and lifestyles.

Our findings thus differ from some previous studies suggesting that that VCO could function as a ‘license to pollute’ (Tao et al., 2021; Reimers et al., 2021; Warburg et al., 2021). The results suggest that air travel is the one realm in which carbon offsetting is sometimes used as such a ‘license’. Offsetting flights is not associated with many environmentally sustainable practices. It is not associated with higher climate concern or income, either. However, those who fly, are more likely to favour pre-offset products. It may be that the heightened public attention to emissions from flying, as well as the practice of airline companies to offer offsetting directly to consumers when they book a flight, make more frequent flyers more aware of offsetting in general. It should also be noted that Finland is a northern country, where almost any travel abroad normally entails flying. More sustainable options are not as widely available as in, for example, Central Europe, and some may consider flying nearly unavoidable.

Third, according to the results of previous studies, the young, the more educated and those with higher income are more likely to offset their flight emissions (Cordes et al., 2024; Blasch and Farsi, 2014; Mair, 2011). Our results do not support earlier results in this respect, since in our study young age and income were not associated with offsetting in any of the models. According to our results, women, those politically positioned towards the left, and those not owning forest were more likely than others to favour products with a pre-offset carbon footprint. The result may reflect cultural or contextual factors, calling for further investigation into gender dynamics in political consumerism.

The highly educated were less likely to offset any of the practices compared to other educational groups. This finding contrasts with some literature suggesting that higher education levels correlate with increased environmental awareness and action (Copeland and Boulianne, 2022) and political consumerism (e.g., Berlin, 2011; Neilson and Paxton, 2010). While our study cannot give a conclusive answer to this contradiction, we consider that there may be two explanations. It is possible that the highly educated may be more critical of the efficacy, transparency and morality of VCOs, perceiving them as inadequate substitutes for direct emission reductions. There was general criticism towards offsetting, such as a report by a Finnish NGO investigating offsetting practices of Finnish companies (Finnwatch, 2021), and a number of media reports questioning the efficacy of offsetting (e.g., Hukkanen and Kanerva, 2020). In addition, there was an exceptional and unique controversy regarding the legal status of offsetting in Finland, discussed extensively also in the media in 2018–2023, as described by Lehtimäki et al. (2025). Perhaps the more educated followed this discussion more closely than others and thus became hesitant to commit to offsetting.

Left-wing political orientation and increased climate concern were associated with only one kind of VCO practice, favouring pre-offset products. For this practice, our results thus align with literature suggesting that political consumerism is associated with a left-wing political orientation (Berlin, 2011; Micheletti and Stolle, 2012; Sandovici and Davis, 2010) and left-leaning individuals tend to report higher levels of concern about climate change (McCright et al., 2016; Gregersen et al., 2020).

We anticipated that the ownership of forest might be associated with offsetting in Finland. As forests are often a carbon sink, a forest owner could think they are “offsetting” their emissions from consumption. However, this particularly Finnish phenomenon of private forest ownership was not associated with any of the offsetting practices, although the association with Model 2 (favouring pre-offset products) was close to statistical significance ($p = .054$) (Table S6 in Supplementary material). The normal growth of forests is, in fact, not considered additional so that it could be used for offsetting. Instead, additional forest management practices that increase carbon intake into the forest, such as fertilizing, are used in Finland to create carbon credits.

We acknowledge several limitations in our study. The survey had a

relatively low response rate of 15%, which must be considered when evaluating the results. Such a response rate is rather common in surveys administered by private research companies. The research data were collected among volunteers. Therefore, it is possible that those who are more likely to respond to surveys represent those who are active citizens. Compared to the Finnish population, the sample is more educated, wealthier, and more urban, characteristics that are related to pro-environmental behaviour. Therefore, it is possible that our findings overestimate the prevalence of VCO. It should also be noted that the data was collected during flying was discouraged or restricted due to Covid-19 pandemic, which has very likely affected the findings related to flying and offsetting the emissions from flying.

Moreover, the study relies on consumers' self-reported responses, which may not fully reflect actual purchasing decisions, and social desirability bias may lead to an overestimation of respondents' climate-friendly attitudes and behaviours. Consumers may also conceptualize the term 'offsetting' more widely than official definitions and for them it does not necessarily mean buying carbon credits only. For example, consumers can report using public transport instead of driving a car and understanding this as 'offsetting' (Karhunen et al., 2023). Thus, the 'offsetting experience' can vary between respondents. Moreover, we do not know why respondents decided to offset their carbon emissions e.g., whether their flying was non-avoidable or whether they used VCO for justifying flying. Therefore, future research could investigate consumers' motivations for offsetting. The finding that higher education is negatively associated with VCO is surprising. Further study could show whether this only followed from the intensive discussion regarding offsetting in Finland at the time of the reported behaviour. The positive association between flying and buying pre-offset products could also result from many reasons, which this data cannot answer. Additionally, future research should examine the motivations underlying changes in consumption behaviours (e.g., dietary choices), distinguishing between environmental, health-related, and other drivers.

Another limitation relates to measuring several key concepts using single-item indicators. Although these are commonly used to measure specific behaviours, they may affect measurement quality. Single-item measures may be susceptible to random measurement error, which can lead to biased estimates of the relationships between variables. Although the use of single-item measures may be justified for unambiguous behaviours, the findings should be interpreted cautiously, especially regarding generalizability. Future research would benefit from validated multi-item scales to improve reliability. Yet another methodological limitation relates to the transformation of scales used in variables in order to ensure the overall stability and reliability of the regression models. Combining multiple response categories into fewer categories inevitably leads to a loss of nuance in the data.

This is a cross-sectional study; while it allows for the evaluation of certain types of associations, it does not permit strong causal conclusions to be drawn. The study was carried out during a period, when VCO was discussed in a particular way in the Finnish media, which may have influenced respondents' perceptions. It would be important to conduct a longitudinal study in the future, which would make it possible to draw causal conclusions. In addition, as the offset market and regulations surrounding it are still evolving, further studies are needed to analyse consumers' understanding and use of offset services. Lastly, since the findings are based solely on data from Finland, the conclusions may not be directly applicable to other cultural contexts and with varying VCO markets. Therefore, it would be also important to collect data from geographically diverse countries.

Despite these limitations, our results suggest that apart from flying, voluntary carbon offsetting does not appear to function as a 'license to pollute'. Therefore, voluntary carbon offsetting appears to be a part of broader practices of lifestyle political consumerism that aim to reduce or avoid negative environmental impacts of consumption.

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CRediT authorship contribution statement

Laura Salmivaara: Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Annukka Vainio:** Conceptualization, Funding acquisition, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Mari Niva:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Kalle Aro:** Conceptualization, Writing – review & editing. **Vilja Varho:** Conceptualization, Funding acquisition, Investigation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.clrc.2026.100477>.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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